Exhibit 1

Short Sellers and Financial Misconduct

Jonathan M. Karpoff and Xiaoxia Lou*

Abstract

We examine whether short sellers detect firms that misrepresent their financial statements, and whether their trading conveys external costs or benefits to other investors. Abnormal short interest increases steadily in the 19 months before the misrepresentation is publicly revealed, particularly when the misconduct is severe. Short selling is associated with a faster time-to-discovery, and it dampens the share price inflation that occurs when firms misstate their earnings. These results indicate that short sellers anticipate the eventual discovery and severity of financial misconduct. They also convey external benefits, helping to uncover misconduct and keeping prices closer to fundamental values when firms provide incorrect financial information.

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Short selling is a controversial activity. Detractors claim that short sellers undermine investors' confidence in financial markets and decrease market liquidity. For example, a short seller can spread false rumors about a firm in which he has a short position and profit from the resulting decline in the stock price.[1] Advocates, in contrast, argue that short selling facilitates market efficiency and the price discovery process. Investors who identify overpriced firms can sell short, thereby incorporating their unfavorable information into market prices. In his account of short selling in Allied Capital, Inc., hedge fund manager David Einhorn argues that short sellers even help uncover financial reporting violations (Einhorn 2008).[2]

In this paper we investigate whether short sellers do in fact identify overpriced firms, and whether in the process they convey external benefits or harms upon other investors. We do so by measuring short selling in a set of firms that, *ex post*, clearly were overpriced: those that are disciplined by the SEC for financial misrepresentation. In our sample of 454 firms from 1988 through 2005, 96% have negative abnormal returns on the days their misconduct was publicly revealed, with an average one-day stock price decline of 18.2%. So these firms provide a natural test of the view that short sellers can anticipate bad news.

The results of three tests indicate that short sellers are proficient at identifying financial misrepresentation before it becomes public. First, abnormal short interest rises significantly in the 19-month period before the misrepresentation is publicly revealed. Second, the amount of short selling is positively related to measures of misconduct severity, indicating that short sellers take larger positions when the misrepresentation is particularly egregious. And third,

[1] There are many anecdotes about such strategies, which former SEC Chairman Christopher Cox (2008) called "distort and short." In 2000, for example, investor Mark Jakob turned a $241,000 profit by shorting Emulex stock and spreading an internet rumor that Emulex' CEO was stepping down amid an SEC investigation (see http://www.sec.gov/litigation/litreleases/lr16747.htm and http://www.sec.gov/litigation/litreleases/lr16857.htm). Leinweber and Madhavan (2000) report a case in which investors shorted Sea World stock and spread false rumors that Shamu, Sea World's main attraction, was ill. For other examples, see Barr (2006).

[2] Lamont (2004) and Jones and Lamont (2002) summarize the debate over whether short selling fosters market efficiency or facilitates harmful manipulation. See also Wilchins (2008).

short interest-based indicators of financial misrepresentation in any given firm-month are significantly related to the actual presence of misrepresentation, as revealed in subsequent SEC documents.

We also investigate whether short selling has external effects on other investors. We do not find evidence that short selling imposes external harm by triggering a cascade of selling when the misconduct is publicly revealed. To the contrary, short selling conveys positive externalities to other investors, in two ways. First, the amount of prior short selling is positively related to how quickly the misconduct is publicly revealed. Our point estimates indicate that, among firms that are twelve months into their misrepresentation, those with abnormal short interest at the 75th percentile will be publicly revealed eight months before firms at the 25th percentile.

Short sellers' second external benefit is that they dampen the amount by which prices are inflated while firms report incorrect financial statements. This improves price efficiency and decreases the transfer from uninformed investors who buy shares from insiders or the firm before the misconduct is revealed to the public. We estimate that this price impact translates into savings for uninformed investors that average 1.67% of the firm's market capitalization. Some of these savings are captured by short sellers, who earn profits that average 0.58% of equity value. Even net of such profits, the average net external benefit to uninformed investors equals 1.09% of the firm's equity value.[3]

These findings do not address whether short selling *in general* is informed and beneficial for other investors. For example, we cannot rule out the possibility that some short sellers are noise traders, or that some seek to manipulate prices through false rumors. But in

[3] These point estimates reflect our first measure of abnormal short interest, *ABSI(1)*. Depending on the specific measure, our point estimates of the net external benefit range from 0.19% to 1.53% of equity value. See section V.C and Table IX below.

our events – in which company managers produce falsified financial statements – short sellers play a significant role in identifying, uncovering, and mitigating the effects of financial misconduct.

I. Related research

Our investigation is related to a large body of research that examines whether short sellers target overvalued stocks.[4] The results are somewhat mixed. Asquith and Meulbroek (1996) and Desai, Ramesh, Thiagarajan, and Balachandran (2002) find that highly shorted stocks in one month tend to underperform in the next month, and Diether, Lee, and Werner (2009) find that short sellers appear to take advantage of short-term overreaction in stock prices. Christophe, Ferri, and Angel (2004), Christophe, Ferri, and Hsieh (2009), and Liu, Ma, and Zhang (2008) find that short selling increases before negative earnings announcements, analyst downgrades, and mortgage loss-related write-downs. In contrast, Daske, Richardson, and Tuna (2005) do not find any predictive ability of short selling, and Henry and Koski (2007) find no evidence of informed short selling around SEO announcements.

Our empirical tests employ measures of abnormal short interest that condition on firm characteristics, and thus are related to inquiries into whether short sellers use information about firm fundamentals. Dechow et al. (2001), Asquith, Pathak, and Ritter (2005), and Duarte, Lou, and Sadka (2008) find that short interest is related to market capitalization, book-to-market, and momentum. Richardson (2003) fails to find evidence that short sellers target firms with high accruals. But Cao, Dhaliwal, and Kolasinski (2006) find that short sellers do target firms with high accruals after controlling for surprises in earnings announcements. We find that

[4] See Figlewski (1981), Asquith and Meulbroek (1996), Desai, Ramesh, Thiagarajan, and Balachandran (2002), and Asquith, Pathak, and Ritter (2005).

short interest is related to accruals, as well as market capitalization, book-to-market, momentum, insider selling, institutional ownership, and share turnover.

Three prior studies are most closely related to ours. Dechow, Sloan, and Sweeney (1996) report an increase in short interest in the two months before an SEC release in a sample of 27 Accounting and Auditing Enforcement Releases. Desai, Krishnamurthy, and Venkataraman (2006) and Efendi, Kinney, and Swanson (2006) examine short selling before the accounting restatements in the database compiled by the General Accounting Office (GAO) (2003).[5] Our investigation differs from these papers in several ways. We introduce several controls for the severity of the misconduct, allowing us to infer whether short selling affects stock prices directly, or whether it merely serves as a proxy for misconduct severity. We examine whether short selling tends to concentrate in the misconduct firms. And we estimate the external effects on uninformed investors – including whether short selling helps to expose financial misconduct and whether it dampens price inflation during the violation period. The Internet Appendix contains a tabular summary of the results that are new to this paper.

The data we use also provide for more powerful tests than the GAO (2003) restatement data. Hennes, Leone, and Miller (2008) report that 76% of the restatements in the GAO database are simple errors rather than misrepresentation or fraud, a concern also expressed by Files, Swanson, and Tse (2008). This suggests that the GAO database contains a large number of misclassified events. Even when restatements do reflect financial misconduct, they can occur many months after the misconduct is public knowledge. In our sample, SEC inquiries into financial misconduct are not resolved until 41 months after the initial public revelation, on average. Using a restatement that is made during or after that 41 month period will misclassify when the misrepresentation was or was not public knowledge.

[5] Due to a name change in 2004, the GAO is now called the Government Accountability Office.

II. Data and short interest measures

A. Financial misrepresentation data

To avoid such data problems, we use the Karpoff, Lee, and Martin (2008a,b) (hereafter KLM) database to identify all 632 SEC enforcement actions for financial misrepresentation initiated from 1988 through 2005.[6] These data identify the period during which the misrepresentation occurred and also the *trigger event*, which is the initial public revelation of the misconduct. This allows us to focus on short selling around the initial public revelation. Short interest data are available for 474 of the 632 firms, and 454 firms have sufficient data on CRSP to calculate returns on their revelation dates.

Insert Figure 1 here.

To illustrate the nature of our data and tests, it is useful to review the sequence of events that constitute an SEC enforcement action.[7] These events are summarized in Figure 1. Most enforcement actions follow a conspicuous *trigger event* that publicizes the potential misconduct and attracts the SEC's scrutiny. Common trigger events include self-disclosures of malfeasance, restatements, auditor departures, and unusual trading. Here are two examples of trigger events from our sample:

1. On November 21, 2000, Lucent Technologies Inc. announced that it had identified a revenue recognition issue in its already-reported fourth quarter report as the company was completing its financial statements for the fiscal year of 2000. The company also told investors not to rely on its first-quarter forecast of 2001. Share prices fell 16% on the announcement day.

[6] Karpoff, Lee, and Martin (2008a, page 10) report that the database is collected from "…Lexis-Nexis' FEDSEC:SECREL library for information on SEC securities enforcement actions, the FEDSEC:CASES library for information on litigated enforcement actions, and the Academic Business News, General News, and Legal Cases libraries for news releases (frequently issued by defendant firms) about each enforcement action … the SEC's website at http://www.sec.gov, which contains all SEC public releases relating to enforcement actions since September 19, 1995… the Department of Justice itself, which provided … further data on enforcement outcomes [, and] the Department of Justice's Corporate Fraud Task Force website at http://www.usdoj.gov."

[7] The following two paragraphs follow section III in Karpoff, Lee, and Martin (2008b).

2. On November 13, 2003, Virbac Corporation announced that it was delaying filing its third quarter 2003 Form 10-Q. Share prices fell 22% on the announcement day.

Following a trigger event, the SEC gathers information through an informal inquiry that may develop into a formal investigation of financial misconduct. At this point the SEC may drop the case, in which case it does not appear in our sample. If the SEC proceeds, it typically sends a Wells Notice to prospective defendants, notifying them that it intends to begin enforcement proceedings. It then imposes administrative sanctions and/or seeks redress through civil actions. Some cases are referred to the Department of Justice and lead to criminal charges as well. The SEC releases its findings and penalties in its Administrative Releases and Litigation Releases, and every enforcement action in our sample has at least one such release. These releases provide detailed information on the period over which the misrepresentation occurred – which we label the violation period – as well as other information that we use in our empirical tests.

Insert Table I here.

As reported in Table I, the events illustrated in Figure 1 typically take several years to play out. In our sample of enforcement events, the median length of the violation period is 24 months, and the median length from the beginning of the violation until its initial public revelation is 26 months. From the initial public revelation until the end of the enforcement action takes an additional 41 months. Table I shows that the number of enforcement actions, the median violation period, and median period from the beginning of the violation to its public revelation generally increased from 1988 to 2005.

Panel A of Table II reports that news about financial misrepresentation is associated with large declines in stock price. Return data are available for 454 of our sample firms. For 359 of these firms, the trigger event reported in the KLM database is identified in the SEC's

administrative and litigation releases. The mean one-day market-adjusted return on the SEC-identified trigger date is –20.7%, and the median is –15.0%.

Insert Table II here.

For 95 of our events the SEC identified no trigger date, or the KLM database indicates that there was an earlier public revelation of the misconduct. In 37 of our events, for example, the start of a class action lawsuit is the earliest public revelation of the misconduct. The mean one-day market-adjusted return for these 37 cases is –5.9%. Other less common revelation dates include the announcement of a formal SEC investigation (22 events), an informal SEC inquiry (15), the initial regulatory action and SEC release (12), and bankruptcy filings (8). For all 95 of the revelation dates that are not identified by the SEC, the mean one-day market-adjusted return is –8.9%.

Averaging over all 454 initial revelation dates, the mean abnormal return is –18.2% and the median is –11.1%. In the tests that follow we use data from all 454 events. The results are qualitatively identical, however, if we limit the sample to the 359 events for which the SEC identified the trigger date. Either way, these results indicate that public announcements that firms violated financial reporting rules are associated with large declines in share values. These are exactly the types of event that benefit short sellers.

Panel B of Table II reveals that share prices tend to decrease further when additional news about the misrepresentation is revealed to the public. The announcements in this panel include SEC informal inquiries, SEC formal investigations, Wells Notices, the initiation of regulatory proceedings, the initiation of class action lawsuits, and bankruptcies. A total of 371 of the 454 events have a second announcement. The mean one-day return for these 371 second announcements is –9.6%. A total of 274 events have a third announcement, with a mean one-day return of –7.2%. Combining all 844 subsequent announcements in Panel B, the mean one-

day return is –7.3% with a t-statistic of –15.3. These numbers indicate that subsequent information about these firms' financial misconduct – even after the initial public revelation – also tends to be unfavorable.

B. Short interest data and related data

Our tests examine the ability of short sellers to depict the misrepresentation before it is publicly revealed. So we focus on short interest during the violation period immediately before the initial public revelation dates that are summarized in Panel A of Table II. Monthly short-interest data are obtained from the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and NASDAQ covering the period from January 1988 to December 2005.[8] Short interest reflects the open short positions of stocks with settlements on the last business day on or before the 15th of each calendar month. Settlement, however, takes a few days, and for a short sale transaction to be recorded in month t, it must occur before or on the trade date. Before June 1995, the trade date was five days before the settlement date, and currently it is three days before. We define month *t* as starting from the day after the trade date of calendar month *t*–1 and ending on the trade date of calendar month *t*. Raw short interest for firm *i* in month *t*, SI_{it}, is the percent of total shares outstanding in month *t*. The pooled mean level of SI_{it} over all months for all firms covered by the short interest data is 1.65%.

Monthly stock returns and market capitalization are constructed from daily data obtained from CRSP using the month definition explained above. Some of the analysis requires data on past returns and institutional ownership. Consequently, we use CRSP data

[8] Daily data from January 1, 2005 through August 6, 2007 recently have become available to researchers. These data, however, cover only a small number of the enforcement actions in our sample. The daily data also do not contain information about short positions that are covered, making it impossible to compute net changes in short interest. The monthly data therefore are well suited to our tests.

from January 1987 through December 2005. We obtain data on institutional ownership from the CDA/Spectrum database provided by Thomson Financial. The data, derived from institutional investors' quarterly filings of SEC Form 13F, include quarterly holdings for each stock for each quarter between December 1987 and December 2005.

C. Abnormal short interest

In addition to raw short interest, we examine three measures of abnormal short interest. For firm *i* in month *t*, abnormal short interest equals

$$ABSI(j)_{it} = SI_{it} - E(SI(j)_{it}),\ j = 1, 2, 3, \qquad (1)$$

where SI_{it} is raw short interest and $E(SI(j)_{it})$ is the expected short interest based upon one of three benchmarks *j* that reflect the firm's characteristics.

The first benchmark, $E(SI(1)_{it})$, controls for the firm's market capitalization, book-to-market ratio, past stock performance, and industry. These controls reflect findings by Dechow et al. (2001), Asquith, Pathak, and Ritter (2005), and Duarte, Lou, and Sadka (2008) that short interest is related to market capitalization, the book-to-market ratio, and momentum. At the beginning of each month, each stock is assigned to one of 27 portfolios constructed by independently sorting stocks by size, book-to-market, and momentum, all measured at the end of the prior month. Each of the 27 portfolios is further partitioned into industry groups using two-digit SIC codes. We exclude the sample firms in constructing the matching portfolios.

In particular, $E(SI(1)_{it})$ is the fitted value from a cross-sectional regression that is estimated for each month t:

$$SI_{it} = \sum_{g=low}^{medium} s_{gt} Size_{igt} + \sum_{g=low}^{medium} b_{gt} BM_{igt} + \sum_{g=low}^{medium} m_{gt} Mom_{igt} + \sum_{k=1}^{K} \phi_{kt} Ind_{ikt} + u_{it} \qquad (2)$$

The first three sets of explanatory variables are dummy variables that jointly define the 27 size, book-to-market, and momentum based portfolios. For example, if firm *i* is assigned to the portfolio with the lowest market capitalization in month *t*, then $Size_{i,low,t,}=1$, $Size_{i,medium,t,}=0$, and $Size_{i,high,t}=0$. Industry dummy $Ind_{it,k}=1$ if firm *i* belongs to industry *k* in month *t*. *K* is the total number of industries. By construction, $\sum_{k=1}^{K} Ind_{ikt} = 1$ (so the intercept term is omitted). Each monthly regression uses all firms listed on NYSE, AMEX, or NASDAQ that are not in our SEC enforcement action sample and for which data on short interest, market capitalization, book-to-market ratio, and momentum are available over the period 1988 through 2005.

Insert Table III here.

Table III reports the time-series averages of the coefficient estimates (excluding industry dummies) of the monthly cross-sectional regressions. The associated *t*-statistics are computed with Newey-West (1987) corrections for serial correlation using three lags. The base portfolio in this regression is the portfolio with the highest market capitalization, book-to-market ratio, and momentum for each industry. This means that the coefficients are interpreted as the difference between the short interest of each portfolio and that of the base portfolio. The results show that the largest firms have the highest short interest. Both book-to-market ratio and momentum have U-shaped relations with short interest, as indicated by the different signs of b_1 and b_2, and m_1 and m_2. The relation between the book-to-market ratio and short interest is consistent with the finding in Dechow, Hutton, Meulbroek, and Sloan (2001). The U-shaped relation between short interest and momentum also is documented by Duarte, Lou, and Sadka (2008). Stocks with the lowest book-to-market ratios and lowest past performances are most highly shorted.

Our second measure of abnormal short interest, $ABSI(2)_{it}$, includes additional controls for share turnover and institutional ownership, which D'Avolio (2002) shows are related to

short sales constraints. The coefficients reported in the second column of Table III indicate that short interest increases with both share turnover and institutional ownership. The fitted values from each monthly cross-sectional regression are used to estimate $E(SI(2)_{it})$, the expected amount of short interest for firm i in month t, which in turn is used to calculate $ABSI(2)_{it} = SI_{it} - E(SI(2)_{it})$.

Our third measure of abnormal short interest, $ABSI(3)_{it}$, expands the number of control variables to include total firm accruals and insider selling. Healy (1985), Dechow, Ge, Larson, and Sloan (2007), and others show that accruals can be used to manipulate earnings, and Agrawal and Cooper (2008) show that insider selling is correlated with financial misconduct at many firms. Einhorn (2008) reports that many short sellers base their positions on accruals and insider selling even in the absence of any specific knowledge about the firm. $ABSI(3)_{it}$ reflects short sellers' information over and above their knowledge about accruals, insider selling, or the other control variables.

Our measure of total accruals for firm i in month t is the same as that used by Richardson, Sloan, Soliman, and Tuna (2005):

$$Total\ accruals = \frac{\Delta WC_{it} + \Delta NCO_{it} + \Delta FIN_{it}}{(Assets_{it} + Assets_{i,t-12})/2}. \qquad (3)$$

Here, ΔWC_{it} is firm i's change in non-cash working capital. It is measured as the change in current operating assets, net of cash and short-term investments, minus the change in current operating liabilities, net of short-term debt. Non-current operating accruals, ΔNCO_{it}, is the change in non-current assets net of long-term non-equity investments and advances, less the change in non-current liabilities, net of long-term debt. ΔFIN_{it}, the change in net financial assets, is the change in short-term investments and long-term investments less the change in

short-term debt, long-term debt and preferred stock. *Total accruals* is measured using annual data, so it is the same for all months *t* in a given fiscal year.

To measure *insider selling*, we first calculate net insider selling in each month as the difference between the shares sold and bought by insiders, divided by the firms' outstanding shares. *Insider selling* is then defined as the difference between this measure of net insider selling and its mean over the previous 12 months. A higher number of this variable indicates a higher level of sales by insiders.

The last column of Table III reports the means of the coefficients when *total accruals* and *insider selling* are included in the monthly cross sectional regressions for short interest. Short interest is positively related to both measures. This indicates that short sellers respond to public information about accruals and insiders' trades, even in the absence of financial misrepresentation.

To check the robustness of our results, we replicated many of the tests reported in this paper using four alternate measures of abnormal short interest. The first adds to *ABSI(3)* a control for the dispersion in analysts' forecasts, which Diether, Malloy, and Scherbina (2002) show is correlated with the cost of selling short. The second adds the firm's short interest at the beginning of the violation period as a matching criterion in selecting comparison firms that comprise the benchmark sample. The third uses each firm's own level of short interest before its violation period as its benchmark level of "normal" short interest. And the fourth defines abnormal short interest as a binary variable equal to one when raw monthly short interest exceeds the firm's pre-violation mean level by three standard deviations (this is similar to the method used by Dyck, Morse, and Zingales 2008). As reported in the Internet Appendix, the results using any of these alternate measures are similar to those reported here.

III. Do short sellers identify misrepresenting firms?

A. Short interest around the revelation of misrepresentation

Table IV and Figure 2 report on monthly raw and abnormal short interest during the 40-month period surrounding the month in which financial misconduct is publicly revealed. We have at least some short interest data for 474 firms in the sample, but many of these firms do not have sufficient data to calculate abnormal short interest in some months. This is for two reasons. First, the data required to calculate abnormal short interest is not available for all firms in all months. The data requirements are most severe for *ABSI(3)*, so our sample sizes typically decrease as we move from *ABSI(1)* to *ABSI(3)*. The second reason is that some firms enter the sample fewer than 19 months before their public revelation dates, while some firms leave the sample or do not have short interest data available in the months after public revelation. In sensitivity tests, we find that the results do not change if we restrict the sample to include only firms with data available for all months in the [-19, 0] period.[9]

Insert Table IV here.

Average raw short interest $\overline{SI}_t$ increases steadily from month -19 through month 0, reaching a peak in month +5 before gradually decreasing through month +20. The patterns for all three measures of abnormal short interest are similar. The cross sectional mean of the $ABSI(1)_{it}$, $\overline{ABSI(1)}_t$, is positive in month –19, indicating that these firms are more highly shorted than other firms in the portfolio matched by size, book-to-market, momentum, and industry. $\overline{ABSI(1)}_t$ does not differ significantly from zero at the 5% level, however, until month –17. In month –1, $\overline{ABSI(1)}_{-1}$ has a value of 1.890, meaning that the misconduct firms'

[9] The results also are not sensitive to the [-19, +20] window. In general, abnormal short interest becomes statistically significant around month -17, and it increases steadily, although not monotonically, until five months after public revelation. We also find similar results when the data are partitioned into 1988-1996 and 1997-2005 subperiods.

short interest as a percentage of shares outstanding is 1.890 percentage points higher than firms in the control portfolio. Given that the unconditional mean short interest in any given firm-month is only 1.65% of outstanding shares, this means that short interest in month –1 is more than double the unconditional sample mean level of short interest.

The second and third measures of abnormal short interest are smaller than $\overline{ABSI(1)}_t$ in every month, but both follow a similar pattern. In month –1, $\overline{ABSI(2)}_{-1}$ equals 1.451 and $\overline{ABSI(3)}_{-1}$ equals 1.651. Thus, controlling for share turnover and institutional ownership partly explains the abnormal increase in short interest that is reflected in $\overline{ABSI(1)}_{-1}$. But controlling for total accruals and insider selling does not further decrease the measure of abnormal short interest. These results indicate that the build-up of short interest before the public revelation of financial misrepresentation is not fully explained by such observable firm characteristics as total accruals and insiders' trades. As reflected in Table III, short selling *in general* is sensitive to these characteristics. But the build-up of short interest while firms misrepresent their financial statements is attributable to something else. A plausible explanation is that short sellers act on private information or public information that is not yet reflected in share prices. This is consistent with anecdotes (e.g., as in Einhorn 2008) that short sellers identify overpriced shares through a combination of fundamental analysis and private investigation.

The far right column in Table IV reports the monthly change in the third measure of abnormal short interest, $\Delta\overline{ABSI(3)}_t$. Fifteen of the 19 monthly changes up through month 0 are positive, indicating that the build-up of short interest is fairly steady. To measure the

average monthly rate at which abnormal short interest grows in the pre-revelation period, we estimate the following pooled regression model using firm fixed effects:

$$ABSI(j)_{it} = a_i + \delta \cdot t + \varepsilon_{it} \quad (4)$$

where t is a time trend ranging from –19 to –1. We include firm fixed effects to account for heterogeneity in short-selling activity across firms. Using the first measure of abnormal short interest, $ABSI(1)_{it}$, the estimate of the coefficient for the time trend $\hat{\delta}$ is 0.073 with a t-statistic of 11.7. This indicates that abnormal short interest increases by an average amount of 0.073 percentage points in each of the 19 months leading up to the public revelation of financial misrepresentation. The coefficient $\hat{\delta}$ using the second measure is 0.057 (t = 9.1), and for the third measure is 0.054 (t = 7.9).

Insert Figure 2 here.

The data from Table IV are illustrated in Figure 2. Raw short interest, as well as all three measures of abnormal short interest, increase over the 19 months before the public revelation of financial misconduct, and slowly unwind during the 20 months after public revelation. The Internet Appendix contains an extension of Figure 2 that illustrates the overall pattern of short selling around both the initiation and discovery of financial misconduct.

Notice that abnormal short interest does not immediately drop toward zero in the months after the misconduct is publicly revealed. Instead, it remains high for several months before gradually decreasing, remaining statistically different from zero many months after the revelation. Our short interest data do not provide the individual identities of each short seller, so it is possible that the abnormal short interest after month 0 represents new short sellers taking new positions in the stock. It also is possible that short sellers take time to wind down their positions after month 0. Under either scenario, short sellers can profit even after the

initial revelation of misconduct. The evidence in Panel B of Table II indicates that share prices tend to decline upon subsequent announcements about the misconduct and penalty.

B. Short interest and the severity of misrepresentation

The evidence in Table IV indicates that short sellers detect financial misrepresentation before it is publicly revealed. To probe this interpretation, we examine whether the amount of short selling is related to the severity of the misrepresentation. If short sellers are skilled at ferreting out information about these firms' overvaluation, we would expect short selling to be most pronounced in firms with the most severe reporting irregularities.

We examine cross-sectional differences in the amount of abnormal short interest at month –1 using the following specification:

$$ABSI(j)_{i,-1} = \lambda_0 + \lambda_1 Severity_{i,-1} + \lambda_2 Controls_{i,-1} + \varepsilon_i, \quad j = 1,2,3 \qquad (5)$$

Here, $ABSI(j)_{i,-1}$ is firm i's abnormal short interest measured at the end of month –1, and $Severity_i$ is a measure of the severity of the misconduct. One potential measure of the misconduct's severity is the drop in share value when news of the misconduct is made public. Indeed, we find that the stock return on the trigger date is significantly related to all three measures of abnormal short interest, indicating that short selling is particularly active before public revelations of misconduct that precipitate large price drops. Unfortunately, this result does not directly tie short selling to the misrepresentation's severity. It is possible that short sellers have no specific knowledge of the misrepresentation, and are good only at anticipating large stock price declines. It could also be argued that short sellers manipulate or engineer the large stock price declines. To distinguish between these competing interpretations, we need measures of severity that directly measure the extent of managers' misconduct.

To do that, we use three different proxies for *Severity*: *Fraud*, *Insider trading charges*, and *Total accruals*. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under: (i) Section 17(a) of the 1933 Securities Act, which covers fraudulent actions in the sale of new securities; (ii) Sections 10(a) or 10(b) of the 1934 Exchange Act, which cover fraudulent actions in the purchase or sale of existing securities; or (iii) Sections 15 or 18 of the United States Code, which cover criminal fraud charges. Contrary to popular use of the term "fraud," specific charges of fraud are not universal in SEC enforcement actions for misconduct. Fraud charges are relatively difficult for the SEC or Department of Justice to prove, so they tend to be included only when the financial misrepresentation is egregious and costly (for a discussion, see Cox, Thomas, and Kiku, 2003). In our sample, 79% of all enforcement actions include at least one fraud charge.

Insider trading charges takes the value of one if the enforcement action includes at least one charge of insider trading under sections 10(b)5-1 and 10(b)5-2 of the Exchange Act. In our sample, 19% of all actions include at least one such charge. Agrawal and Cooper (2008) conclude that many managers trade on personal account when their firms' books are in error, and Karpoff, Lee, and Martin (2009) report that securities class action settlements for financial misrepresentation are higher when insider trading charges are included. These results indicate that insider trading charges are associated with egregious and costly misrepresentations.

Our third measure of the severity of the misrepresentation is *Total accruals*, as presented in equation (4). Healy (1985), Dechow, Ge, Larson, and Sloan (2007), and others have shown that accruals can be used to manipulate earnings. We hypothesize that the size of the *Total accruals* correlates with the materiality of the financial misrepresentation.

To verify that *Fraud*, *Insider trading charges*, and *Total accruals* are good proxies for the severity of misconduct, we estimated the relation between each proxy and the market-adjusted one-day return on the revelation date, using the same control variables as in Table V. The results, reported in the Internet Appendix, indicate that each proxy is negatively and significantly related to the abnormal return on the revelation date (p-values of .02 or smaller), indicating that each is a good measure of the severity. One way to think of these proxies is that each is an instrumental variable for the stock price reaction to the public revelation of misrepresentation. The use of these instrumental variables avoids an errors-in-variables problem that would arise if we used the stock return to measure severity in equation (5), because short interest and the stock return upon public revelation both are simultaneously determined by the severity of the misconduct.[10]

Insert Table V here.

Models 1–3 in each panel of Table V report the results when equation (5) is estimated using the three different measures of severity. Each variable is measured at the end of the month just before the public revelation month. The coefficients are all positive and statistically significant, implying that short selling before the public revelation is significantly related to the severity of the misrepresentation. In model 1 of panel A, the *Fraud* coefficient indicates that short interest is 1.650 percentage points higher, on average, when fraud charges are included in the enforcement action. Short interest is 2.034 percentage points higher when the enforcement action includes insider trading charges. The coefficient for *Total accruals* of 5.151 indicates that an increase from the 10th percentile to the 90th percentile in the *Total accruals* measure

[10] The Internet Appendix reports results for four alternate measures of misconduct severity: (i) the monetary award in the private class action lawsuit related to the firm's misconduct, (ii) the monetary fines imposed by regulators, (iii) Karpoff, Lee, and Martin's (2009) index of non-monetary penalties imposed by regulators, and (iv) whether the firm subsequently declared bankruptcy. Measures (i), (ii), and (iv) are significantly related to abnormal short interest, and yield results that are similar to those for *Fraud* and *Total accruals* in Table V. When the alternate measures are included in the tests, the coefficients on *Fraud*, *Insider trading charges*, and *Total accruals* all are positive, generally with lower p-values than reported in the tables.

corresponds to an increase in short interest of approximately 3.021 percentage points. Similar estimates of the economic effects obtain from the results in Panels B and C.

Model 4 in each of the panels includes all three *Severity* proxies in one regression. In all three panels, the coefficients are positive, although only *Total accruals* remains significant at the 5% level in all three panels. This could reflect the high correlations among these proxies.

Among the control variables, high institutional ownership implies more shares available on the stock loan market, which lowers the cost of shorting and increases short interest. The coefficient for size is negative and significant, indicating abnormal short interest is relatively small in large firms. This could reflect the fact that size loads positively in constructing the benchmark levels of expected short interest. Neither the book-to-market ratio nor momentum has a significant impact on abnormal short interest.

The regressions in Table V analyze the determinants of short interest at one point in the time line, namely, the last month before the exposure of the misconduct. In the Internet Appendix we report on how the change in abnormal short interest from month –19 to month –1 is related to the severity of the misconduct. The results from these tests indicate that short interest, and its build-up, are positively related to the severity of the misrepresentation that subsequently is revealed to the public. Short sellers not only pre-identify firms that get into trouble for misrepresenting their financial statements. They also take larger positions when the misrepresentation is particularly egregious. That is, short sellers appear to anticipate both the existence and severity of financial misrepresentation.

C. Do short sellers focus on misrepresenting firms?

The evidence in Tables IV and V (as well as the accompanying results in the Internet Appendix) indicates that short sellers detect financial misrepresentation before it is publicly revealed, and that the extent of short selling is sensitive to the severity of the misrepresentation. But these results are from firms that, *ex post*, faced SEC sanctions for misconduct. They do not address the question of whether short selling *in general* tends to predict the existence of (yet undisclosed) misrepresentation. To explore this issue, we examine whether high levels of abnormal short interest are related to the presence of financial misconduct, using data from all firms for which we have short interest data. Table VI reports results using *ABSI(1)*, although the results are similar using *ABSI(2)* or *ABSI(3)*.

For each month *t*, we classify firms along two dimensions. Firms with *ABSI(1)* in the top 5% are identified as "high short interest firms," while those in the bottom 95% are "low short interest firms." If month *t* overlaps with an SEC-identified violation period for firm *i*, it is designated as a "violation firm-month." This classifies every firm-month in the sample according to whether the firm had high short interest and whether it was cooking its books.

Panel A of Table VI reports on the resulting 2x2 matrix. If short interest tends to be high when firms misrepresent their financial statements, we should see a higher-than-random concentration along the diagonal. That is, high short interest firm-months should correspond with violation firm-months, and low short interest firm-months should correspond with non-violation firm-months. This is exactly what we find. For example, 1.78% of all firm-months are in the "violation" category. But among the high short interest firm-months, 4.18% are in the violation category. A Chi-squared test rejects the null hypothesis that the short interest and violation categories are unrelated ($\chi^2 = 1912$, p-value = 0.00).

Insert Table VI here.

Panel A includes all firm-months for which we have short interest data. Panel B excludes data from months between the public revelation of the misconduct and the end of the SEC enforcement action. This affects only firms with SEC enforcement actions, and has the effect of deleting observations for which short interest may be high, even though the misconduct is public knowledge. Removing these observations yields results that are similar to Panel A. For example, in Panel B, $\chi^2 = 698$ with a p-value = 0.00. These results are consistent with the hypothesis that there is a systematic relation between high short interest and the presence of financial misconduct that has not yet been revealed to the public. That is, short interest is a predictor of the existence of financial misrepresentation in general.[11]

IV. Short sellers' external effects on other investors

In this section we examine whether short sellers confer external costs or benefits on other investors. A potential external cost is that short selling may exacerbate a downward price spiral when the misconduct is publicly revealed. A potential benefit is that short selling may help to uncover the misconduct. A second potential benefit is that short selling may dampen the stock price inflation that occurs when the firm's books are in error.

A. Short selling and the share price reaction to news of misconduct

Critics of short selling argue that it can cause prices to deviate from fundamental values, particularly when bad news hits the market. In written testimony for the U.S. House Committee on Financial Services, for example, MBIA Inc. argues that short sellers increased the downward price pressure on insurers that face large losses in the U.S. mortgage markets

[11] For a more comprehensive investigation of variables that predict financial misconduct, see Dechow, Ge, Larson, and Sloan (2007). Our results indicate that abnormal short interest should be included in such tests. The Internet Appendix reports that we obtain similar results when "high short interest" is defined as the top 10% of *ABSI(1)*.

(see Wilchins 2008). Short selling, according to this view, creates a cascade of selling that leads to overreaction to bad news and drives prices down too far. The SEC's October 2008 moratorium on naked short selling in selected financial institutions was based in part on this theory, as SEC Chairman Christopher Cox argued that short selling contributed to large share price declines at such firms as Lehman Brothers, Bear Stearns, Fannie Mae, and Freddie Mac (e.g., see Cox 2008, Zarroli 2008).

To investigate this argument we examine how short selling is related to the stock price reaction when financial misconduct is revealed to the public. In particular, we estimate the following cross-sectional regression:

$$AR_i = a + f_1\, ABSI(j)_{i,-1} + f_2\, Severity_i + f_3\, Controls_i + e_i, \quad j=1,2,3, \qquad (7)$$

where AR_i is the market-adjusted return on the day misrepresentation is first publicly revealed, and $ABSI(j)_{i,-1}$ is the firm i's abnormal short interest in the month before the month of the revelation date. If the announcement day abnormal return is sensitive to the severity of the misconduct, f_2 should be negative. If, in addition, short selling causes an overreaction that is not related to the severity of the misconduct, f_1 should be negative as well.

Insert Table VII here.

Table VII presents the results using our first measure of abnormal short interest, *ABSI(1)*. In Model 1, the coefficient for $ABSI(1)_{i,-1}$ is negative and significant at the 10% level. This appears to provide support for the view that short selling exacerbates the price drop when bad news hits the market. But Model 1 does not control for the severity of the misconduct. The negative relation between the abnormal stock return and abnormal short interest might simply reflect short sellers' tendencies – documented earlier in Table V – to take larger positions when the misrepresentation is particularly bad.

When we include our measures of severity, as in Models 2-5, the coefficient for $ABSI(1)_{i,-1}$ becomes statistically insignificant. Instead, the coefficients for the severity measures are negative and significant. The results are more pronounced when we use $ABSI(2)_{i,-1}$ or $ABSI(3)_{i,-1}$ to measure abnormal short interest; in these cases the abnormal return never is significantly related to abnormal short interest, but is strongly and negatively related to all three measures of misconduct severity. These results indicate that short selling activity does not have a significant, independent effect on the market reaction to news of financial misconduct. This is inconsistent with the view that short selling causes an unwarranted downward spiral in the stock price when bad news is announced.

We also examined the stock price behavior after the initial disclosure of misconduct. If short selling causes overreaction – either in the short term or long term – then we should see differences in the stock price paths of our sample firms that correspond to differences in short interest. The results, however, do not support an overreaction story. In results reported in the Internet Appendix, we partitioned the sample according to abnormal short interest in month –1. We find no evidence of overreaction on the public revelation day (day 0) in either the high-*ABSI* or low-*ABSI* groups, as there is no price reversal after day 0 in either group. We also find no significant difference in the cumulative excess returns between the high-*ABSI* and low-*ABSI* groups over horizons up to 180 days after day 0. These results indicate that the market responds to the severity of misconduct. But there is no evidence that short selling in and of itself imposes additional downward price pressure, either on the public revelation day or afterwards.

B. Do short sellers help to expose financial misrepresentation?

B.1. Short interest and the time-to-revelation

Short selling advocates (e.g., Einhorn 2008) argue that short sellers generate external benefits by helping to expose financial misrepresentation. To our knowledge, this assertion has not been tested, although a recent paper by Dyck, Morse, and Zingales (2008) provides some evidence. Dyck et al. examine spikes in short interest before the announcements of security class action lawsuits from 1996-2004, most of which are for financial misrepresentation. An event is labeled "detected by short sellers" if the raw short interest during the three months before the filing date exceeds the firm's short interest in the prior year by three standard deviations. Dyck et al. conclude that between 3.4% and 14.5% of their 216 events are detected by short sellers. This estimate suggests that short sellers play a modest role in helping to uncover financial misconduct.

We examine this issue by estimating survival models that measure how short selling affects the time it takes for misrepresentation to be publicly revealed. Specifically, we model the logarithm of time-to-revelation, $\log(M_i)$, as

$$\log(M_i) = \beta' X_i + \varepsilon_i . \qquad (8)$$

Here, M_i is the number of months from the beginning of firm i's violation until its revelation, X_i is the vector of possibly time-varying covariates assumed to influence the time until public revelation, and β is a vector of regression parameters that we estimate. The error term ε_i is assumed to follow the logistic distribution.[12]

[12] We obtain qualitatively identical results using a discrete version of Cox's (1972) semi-parametric proportional hazard model. The Cox model requires no assumption about the distribution of ε_i in equation (8). An advantage of the parametric specification, however, is that it enables us to obtain quantitative estimates of the impact of short selling on the time-to-revelation, as reported below.

In estimating the model, we use data from all months from violation until the revelation of misconduct. Letting T_{it} denote the number of months from the start of violation, we use all firm-months such that $0 < T_{it} \leq M_i$. The explanatory variables X_i are measured at the beginning of each month t. For each month t, we observe the following vector [t, $Revelation_i$, X_i], where $Revelation_i$ is a dummy variable that equals one if firm's misconduct is revealed in month t, i.e., $M_i = T_{it}$, and zero otherwise, i.e., $M_i > T_{it}$. A log-likelihood function can then be constructed to estimate the parameter vector β. To mitigate contaminations from outliers, only violations that last more than a year but less than or equal to ten years are included in the estimates we report, although the results are not sensitive to the inclusion of all events. In the data matrix X_i we include controls for institutional ownership, size, book-to-market ratio, and momentum.

Insert Table VIII here.

Model 1 in Panel A of Table VIII reports the impact of abnormal short interest on the time to exposure. We report results using *ABSI(1)*, although the results are similar using *ABSI(2)* and *ABSI(3)*. The coefficient is –0.028 and is statistically significant, indicating that short selling is associated with a more rapid exposure of the misconduct. In models 2-5 we include controls for the severity of the misconduct. The coefficients for *Fraud* in Model 2 and for *Total accruals* in Model 4 both are negative and statistically significant, consistent with the view that severe misrepresentations are discovered relatively quickly. These results maintain in Model 5, which includes all three severity measures together. Most importantly for our investigation, the coefficient for abnormal short interest is negative and significant in all model specifications. This implies that short selling is positively related to the speed with which financial misrepresentation is uncovered.

The coefficient estimates from the parametric log-logistic model allow us to quantify how abnormal short interest affects the time until misrepresentation is discovered. Consider short interest in firms whose violations have been ongoing for 12 months. Using Model 5 estimates and inserting mean values for all other variables, a firm at the 75th percentile of abnormal short interest eventually will have its misconduct uncovered 8 months sooner than a firm at the 25th percentile. As reported in Table I, the median time-to-revelation is 26 months, so a reduction in the time-to-revelation of 8 months represents a significant impact of short selling on the time it takes to uncover the misconduct.

B.2. Endogeneity

Table V shows that short sellers take particularly large positions when the misrepresentation is particularly egregious. Suppose that egregious misrepresentations are discovered quickly, not due to the short selling, but rather, because their severity prompts a fast response from investors or regulators. In this case we would not conclude that short interest accelerates the time-to-discovery, but rather, that both short interest and time-to-discovery are driven by the severity of the misconduct.

This concern is mitigated somewhat by including measures of misconduct severity in the empirical tests, as in Panel A of Table VIII. The severity measures, however, may be imperfect. To further control for a possible omitted variables bias in estimating equation (8), we construct an instrumental variable for short interest. The instrumental variable is the fitted value from the following cross-sectional model, which is estimated for each month *t*:

$$ABSI(j)_{it} = \delta_{0t} + \delta_{1t} Options_{it} + \varepsilon_{it}, \quad j = 1,2,3. \tag{9}$$

In equation (9), $Options_{it}$ is a dummy variable set equal to one if the stock has listed options on the CBOE in month *t*. Diether et al. (2009) find that short selling activity is positively related to the availability of options markets trading. This is for two reasons. First, listed options can decrease the cost of hedging short positions. And second, firms with listed options may be less expensive to borrow and sell short since stocks with options tend to be larger and more liquid. Consistent with such prior findings, we find that the mean of the cross-sectional coefficients $\hat{\delta}_{1t}$ in equation (8) is positive and significant using all three measures of abnormal short interest. Using coefficient estimates $\hat{\delta}_{0t}$ and $\hat{\delta}_{1t}$ from equation (9), we create an instrumental variable equal to the fitted value $ABSI(j)_{i,-1}$.[13]

Panel B of Table VIII reports the results of the instrumental variable estimation. We use the same specification as in Model 5 of Panel A, except that we replace $ABSI(j)_{i,-1}$ with the instrumental variable $ABSI(j)_{i,-1}$. Using any of the three measures, the coefficient for the instrumental variable is negative and statistically significant ($p < .001$). This relation is robust to controls for the severity of the misrepresentation, which also are positively related to the speed with which misrepresentation is uncovered.

The evidence from both Panels A and B in Table VIII indicates that short sellers play an important role in helping to uncover financial misrepresentation. These results are contrary to the estimates by Dyck et al. (2008), which imply that short sellers play at most a modest role in helping to unveil business misconduct.

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[13] In most tests, $ABSI(j)_{i,-1}$ satisfies the exclusion restriction for an instrumental variable, as it is not significantly correlated with the residual in the time-to-revelation models. An exception is Model 2 in Panel B of Table VIII, for which the instrument is significantly correlated with the residual. For discussions of instrumental variable tests with hazard models, see Abbring and Van den Berg (2005) and Bijwaard (2008).

C. External effects of short selling on prices and share quantity

In addition to impacting the time-to-revelation, short selling can affect share prices and the number of shares held by other investors. Uninformed investors can benefit if short selling keeps prices closer to their full-information values. But they also can be harmed by the extent of short sellers' profits.

Insert Figure 3 here.

Figure 3 illustrates these two external effects. P_{actual} represents the price at which shares trade in any given month t during the violation period. In the absence of informed short selling, the inflated price presumably would have been higher, P_{high}. The difference, $P_{high} - P_{actual}$, represents short sellers' price impact. When uninformed investors trade with each other, the net distributional effect of the price impact is zero. But when uninformed investors buy from informed sellers, the price impact conveys an external benefit, which is illustrated by Area B (for "Benefit") in Figure 3. We consider trades with two types of informed sellers: insiders and the firm itself. Area B equals the price impact, $P_{high} - P_{actual}$, times the net number of shares sold by insiders or issued by the firm in month t. It is a measure of uninformed investors' savings when they buy from informed parties – insiders or the firm itself – who are most likely to gain from the artificial inflation in share prices that occurs when the firm issues falsified financial statements.

Short sellers also impose external costs on uninformed investors. Borrowing shares to sell short increases the number of shares held by uninformed investors.[14] Uninformed investors buy these shares during the violation period, when the shares typically are overpriced. In Figure 3, P_{true} is the value that would obtain if the firm's financial statements were not in

[14] For a discussion, see Apfel, Parsons, Schwert, and Stewart (2001). Apfel et al. also point out that, because it increases the number of shares held long, short selling makes it difficult to identify which shareholders have standing to sue in 10b-5 class action lawsuits for financial fraud. This is a potential cost of short selling that our tests do not measure.

error. Every short sale occurs at a price that is inflated by the amount $P_{actual} - P_{true}$. The total external cost to uninformed investors, represented by Area C (for "Cost"), equals $P_{actual} - P_{true}$ times the number of shares sold short.

Notice that Area C represents short sellers' gain. If Area C equals Area B, short sellers internalize their external benefits exactly. If B is positive but less than C, then short sellers generate external gains for uninformed investors, but these gains are more than offset by their profits. If B is greater than C, then short sellers generate external gains that exceed their profits.

To estimate Areas B and C, we need estimates of $P_{high} - P_{actual}$ and $P_{actual} - P_{true}$. For P_{high}, we first estimate a cross-sectional model for share returns, ret_{it}, using firms not in the SEC enforcement action sample:

$$ret_{it} = \beta_0 + \beta_1 Size_{i,t-1} + \beta_2 BTM_{i,t-1} + \beta_3 Mom_{i,t-1} + \sum_{k=1}^{K} Ind_{ik,t-1} + \beta_4 ABSI(j)_{i,t-1} + \varepsilon_i \qquad (10)$$

Equation (10) is estimated for each month *t*, and the explanatory variables are measured at the end of the prior month *t-1*. The key to this model is the inclusion of abnormal short interest, $ABSI(j)_{i,t-1}$. The mean estimate $\hat{\beta}_4$ is negative, indicating short selling does indeed have an impact on prices. Using *ABSI(1)*, for example, the mean of the monthly coefficients $\hat{\beta}_4$ is –.091 with a t-statistic of –10.52.

The hypothetical return if abnormal short interest were zero, ret_{it}^{high}, is:

$$ret_{it}^{high} = r_{it} - \hat{\beta}_4 \, ABSI(j)_{i,t-1} \qquad (11)$$

For each firm-month, we calculate the hypothetical cumulative return, $cumret_{it}^{high}$, from the beginning of the violation:

$$cumret_{it}^{high} = \sum_{\tau=1}^{t} ret_{i\tau}^{high} . \quad (12)$$

The hypothetical stock price, P_{high}, is then calculated as $P_0 * cumret_{it}^{high}$, where P_0 is the stock price at the beginning of the violation period. In measuring P_0, we adjust for stock splits using the cumulative adjustment factor provided by CRSP. $P_{high} - P_{actual}$ is the difference between P_{high} and the actual price at the end of the contemporaneous month.

We use two estimates of $P_{actual} - P_{true}$. Our upper bound estimate equals the actual price in month t minus the price per share immediately after the misconduct is revealed. Our lower bound estimate equals only 24.53% of this difference. The rationale for the upper bound estimate is that the post-revelation price reflects investors' valuation after they adjust for the news that the price previously had been inflated by falsified financial statements. The rationale for the lower bound estimate is that, as Karpoff, Lee, and Martin (2008b) report, the post-revelation share price falls more than the price inflation that we can attribute to the misconduct. The price drop also reflects investors' expectations of future legal penalties and the firm's reputation loss. Karpoff, Lee, and Martin (2008b, page 600) estimate that 24.53% of the price drop represents the amount by which prices were inflated by the financial misrepresentation.

We use these variables to calculate Areas B and C for each month of the violation period as a percentage of the firm's market capitalization. For each firm, we sum the monthly estimates of Area B to obtain a firm-specific estimate of short sellers' external benefits. Likewise, we sum the monthly estimates of Area C to obtain a firm-specific estimate of short sellers' profits, which also is a measure of the external costs imposed on uninformed investors.

Insert Table IX here.

Table IX reports on the resulting estimates using *ABSI(1)* to measure abnormal short interest. Estimates using *ABSI(2)* and *ABSI(3)* are in the Internet Appendix. During the violation period, insiders and the firm jointly sell shares that average 45.65% of the firm's

outstanding common stock, with a 95% confidence interval of [26.24%, 65.06%] (the t-statistic is 4.61). The time series mean of short sellers' monthly price impact, expressed as a percentage of the beginning month share price, is 2.41%. Together, these imply that short sellers' external benefit to uninformed investors – the sum of the monthly measures of Area B – is 1.67% of the firm's market capitalization (95% confidence interval of [0.25%, 3.09%]).

Note that the median values are much smaller. The quantity distribution is skewed right, as a small number of firms issue a large number of shares. The distribution of price impact also is skewed right, and for the median firm, short sellers' external benefit is negligible. Thus, short sellers generate external benefits, on average. But these benefits are negligible for the median firm. Further examination reveals that the right skew in the distribution of external benefits reflects a small number of firms that issued stock during their violation periods, including Cendant Corp., Waste Management Inc., Triton Energy Corp. America Online, Inc., and Royal Ahold NV.[15]

Panel A also reports on short sellers' profits. During the violation period, the average change in *ABSI(1)* is 1.12% of outstanding shares (confidence interval of [0.54%, 1.70%]), and our upper bound mean estimate of $P_{actual} - P_{true}$ is 12.13% of share value per month. Averaging across firms, short sellers' mean profit is 0.58% of the firm's market capitalization. That is, short sellers cumulatively generate profits on the positions they take during the violation period that average 0.58% of the firm's equity value.

The mean net effect, equal to the sum of the differences between each firm's monthly estimates of Areas B and C, is 1.09% of equity value. Note, however, that the confidence interval [–0.80, 2.98] indicates that this estimate is noisy. Furthermore, the median value is

[15] This finding is consistent with arguments that one reason firms misrepresent their financials is to issue new shares at a favorable price (e.g., see Dechow, Sloan, and Sweeney 1996; Efendi, Srivastava, and Swanson 2007).

negative, albeit small in magnitude (-0.06% of equity value). This indicates that, for most firms, short sellers internalize their external benefits via their trading profits, generating no net external benefits for shareholders. But in a small number of firms, short sellers' net external benefits are positive and large. The net external benefits in these relatively few cases are large enough to generate a positive mean estimate of the external benefit.

If we use the lower bound estimate of short sellers' external costs, the net external benefit is larger. The lower bound estimate of external costs is 0.14% of equity value, increasing the mean estimate of short sellers' net external benefits to uninformed shareholders to 1.53% of equity value (confidence interval of [0.01, 3.05]). This larger estimate of net benefits is appropriate if we think of P_{true} as the price that would have obtained if the firm had never misrepresented its financials in the first place, i.e., we exclude from the definition of P_{true} any legal penalties and reputation losses that accrue to firms that misrepresent their financials.

These results indicate that short sellers generate external benefits for uninformed investors, which in the median case they internalize with their trading profits. For a small number of firms, however, the external benefits are large enough to affect the overall mean estimates. Short sellers generate net external benefits particularly when they take positions in misrepresenting firms that issue new (overpriced) shares to uninformed investors.

V. Conclusions

Short sellers attract a lot of attention. They are blamed for manipulating and depressing share values, and for exacerbating price declines when bad news is announced. They also are credited with improving financial markets' informational efficiency. We provide evidence on one aspect of short sellers' effects on markets, by examining short selling before the public

revelation that firms misrepresented their financial statements. Such revelations are material events, as they are associated with an average one-day share price decline of 18%. Short sellers anticipate such announcements, as abnormal short interest builds steadily in these stocks during the 19-month period before the public revelation. The amount of short selling increases with the severity of the misrepresentation, indicating that short sellers are sensitive to the characteristics of the misconduct. High short interest also concentrates in firms that misrepresent their financials, compared to firms that do not.

These results imply that short sellers are proficient at identifying financial misrepresentation before the general investing public. Our measures of abnormal short interest control for firm characteristics that are known to correlate with – and possibly motivate or facilitate – short selling, including firm size, book-to-market ratio, momentum, share turnover, institutional ownership, insider trading, and total accruals. So short sellers do not merely track such firm characteristics. Their positions appear also to be based on private information or a superior synthesis of public information about whether firms are cooking their books.

We also examine short sellers' external effects on other investors. Contrary to some claims (e.g., see Wilchins 2008, Zarroli 2008), short selling does not exacerbate the decline in share prices when bad news is announced. To the contrary, short selling conveys external benefits to uninformed investors, in two ways. First, short selling is associated with the speed with which financial misrepresentation is detected. Among firms that are have been misrepresenting their financials for 12 months, our point estimates indicate that a firm at the 75th percentile of abnormal short interest will be publicly revealed eight months sooner than a firm at the 25th percentile. Thus, short selling not only anticipates financial misconduct; it also helps expose the misconduct.

The second external benefit is that short selling mitigates the mispricing that occurs when firms misrepresent their financial statements. This price impact conveys offsetting benefits and costs to uninformed investors who trade with each other. But for uninformed investors who purchase shares from insiders or the firm, the benefits can be substantial. We estimate that this benefit equals 1.67% of the firm's market capitalization. Short sellers internalize some of this benefit, profiting by an amount that averages 0.58% of the firm's equity value. Net of this profit, short sellers' net external benefit is still positive, averaging 1.09% of the firm's equity value.

These results indicate that short sellers tend to ferret out and help uncover financial misconduct by corporate managers. Short sellers profit from their positions in firms whose misconduct subsequently is revealed. Yet, even net of these profits, short sellers generate external benefits for uninformed investors. By improving market efficiency through its effects on prices, short selling offsets some of the harm imposed on uninformed investors who unwittingly buy shares from firms and insiders while the firm's books are in error.

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Table I: Description of the Financial Misrepresentation Sample

This table describes the yearly distribution of the 632 SEC enforcement actions for financial misrepresentation from 1988 through 2005. The violation period is the date the financial misrepresentation began until it ended, as identified in SEC litigation or administrative releases. The revelation date is the earliest date that information about the misrepresentation was made public. Most revelation dates are identified in SEC releases, and the remaining are identified in the Karpoff, Lee, and Martin (2008a,b) database. Revelation events include firm disclosures, restatements, auditor changes, SEC filing delays, whistle-blower charges, class action lawsuit filings, bankruptcy filings, and SEC actions (informal inquiries, formal investigations, Wells Notices, or first regulatory proceeding).

		Violation period (months)		Violation beginning to public revelation (months)	
Year	# of Cases	Mean	Median	Mean	Median
1988	25	20	24	31	28
1989	13	25	23	30	23
1990	28	20	15	29	22
1991	34	34	24	35	30
1992	35	26	24	32	28
1993	32	24	20	31	24
1994	46	22	17	29	22
1995	29	26	24	28	25
1996	37	29	27	33	27
1997	34	26	24	32	24
1998	36	30	21	33	25
1999	36	33	30	33	24
2000	67	27	24	28	23
2001	49	26	21	25	20
2002	70	32	24	33	27
2003	31	32	33	35	29
2004	17	32	32	41	36
2005	13	42	36	46	36
Total	632	28	24	31	26

Table II: Share Price Reactions to Announcements of Financial Misrepresentation

This table presents summary statistics on the one-day market-adjusted returns for key dates in the sample of 454 SEC enforcement actions for financial misrepresentation from 1988–2005, for which sufficient returns data are available on CRSP. The market-adjusted return is the firm's return minus the CRSP value-weighted return on the same day. Panel A reports market-adjusted returns for the revelation date, which is the earliest date that information about the misrepresentation was revealed to the public. Most (359) revelation dates are identified by the SEC, and include firm disclosures, restatements, auditor changes, SEC filing delays, and whistle-blower charges. In 95 cases, the initial revelation date is identified in the Karpoff, Lee, and Martin (2008a,b) database. These events include announcements of an SEC informal inquiry or formal investigation, announcements of a Wells Notice (which is the SEC's notification to respondents that it intends to take action), the initiation of regulatory proceedings, class action lawsuits, and, bankruptcy announcements. Panel B reports on important announcements about the misrepresentation that were made after the public revelation date. These subsequent events include announcements of an informal SEC inquiry, formal SEC investigation, Wells Notice, initiation of regulatory proceedings, initiation of class action lawsuits, and bankruptcy. There are a total of 844 such subsequent announcements. Of these, 371 are follow-ups to the initial revelation date. Of these 371 cases, 274 have a third announcement, 147 have a fourth announcement, and 46 have a fifth announcement.

	N	Mean (%)	Median (%)	t-stat
Panel A: Initial public revelation date				
All initial revelation dates	454	-18.20	-11.10	-19.90
SEC-identified trigger event	359	-20.70	-15.00	-19.00
Other initial revelation events	95	-8.90	-5.77	-8.55
– SEC informal inquiry	15	-12.10	-11.70	-5.17
– SEC formal investigation	22	-9.32	-6.09	-4.62
– SEC Wells Notice	1	-1.03	-1.03	N/A
– Regulatory proceedings begin	12	-6.29	-1.97	-2.98
– Class action lawsuits begin	37	-5.93	-3.73	-5.12
– Bankruptcy	8	-20.40	-14.40	-3.00
Panel B: Important subsequent announcements				
2nd announcement	371	-9.61	-4.96	-12.41
3rd announcement	274	-7.22	-3.97	-8.85
4th announcement	147	-3.52	-1.95	-4.88
5th announcement	46	-0.00	-0.90	0
6th or higher announcement	6	-13.76	-6.09	-1.53
All subsequent announcements combined	844	-7.28	-3.69	-15.30

Table III: Models Used to Calculate Abnormal Short Interest

For each month *t,* short interest (*SI*) is regressed on variables that are likely to explain the level of short interest that is unrelated to short sellers' information about financial misconduct. Short interest (*SI*) is the number of shares shorted as a percentage of the number of shares outstanding. The table reports the time-series means and *t*-statistics of the monthly coefficient estimates. For Model 1:

$$SI_{it} = \sum_{g=low}^{medium} s_{gt} Size_{igt} + \sum_{g=low}^{medium} b_{gt} BM_{igt} + \sum_{g=low}^{medium} m_{gt} Mom_{igt} + \sum_{k=1}^{K} \phi_{kt} Ind_{ikt} + u_{it}$$

Explanatory variables include size, book-to-market ratio, and momentum, all measured at the beginning of month *t.*The explanatory variables are dummy variables. For example, if firm *i* is assigned to the portfolio with the lowest market capitalization in month *t*, then $Size_{i,low,t} = 1$, $Size_{i,medium,t} = 0$, and $Size_{i,high,t} = 0$. Model 2 includes dummy variables for share turnover and institutional ownership, and Model 3 includes continuous variables for total accruals and insider selling. All three regressions include industry dummies with $Ind_{ikt} = 1$ if firm *i* belongs to industry *k* in month *t*. *K* is the total number of industries, and industry is defined using two digit SIC codes from CRSP. The sample includes all firms listed on NYSE, AMEX, or NASDAQ that are not in the SEC enforcement action sample and for which data are available during the 1988 through 2005 period. *t*-statistics are computed with Newey-West (1987) corrections for serial correlation using three lags.

	Model 1 (used to calculate *ABSI(1)*)	Model 2 (used to calculate *ABSI(2)*)	Model 3 (used to calculate *ABSI(3)*)
$Size_{low}$	-1.952	-0.709	-0.813
	[-13.09]	[-8.22]	[-8.32]
$Size_{medium}$	-0.922	-0.322	-0.395
	[-9.92]	[-4.76]	[-5.02]
BM_{low}	0.345	0.270	0.264
	[7.49]	[6.51]	[6.28]
BM_{medium}	-0.353	-0.266	-0.286
	[-14.12]	[-11.92]	[-12.05]
$Momentum_{low}$	0.402	0.454	0.466
	[8.16]	[11.07]	[10.30]
$Momentum_{medium}$	-0.147	0.093	0.093
	[-5.48]	[3.64]	[3.59]
$Turnover_{low}$		-2.261	-2.248
		[-16.10]	[15.73]
$Turnover_{medium}$		-1.899	[-1.88]
		[-16.14]	[-15.72]
Institutional $ownership_{low}$		-0.949	-0.931
		[-10.46]	[-8.94]
Institutional $ownership_{medium}$		-0.588	-0.531
		[-8.38]	[-6.84]
Total accruals			0.419
			[7.38]
Insider selling			3.823
			[10.28]
Industry controls	Yes	Yes	Yes
Adj-R^2	0.21	0.27	0.28

Table IV: Short Interest and Abnormal Short Interest Around the Revelation of Misconduct

This table reports the mean levels of short interest (*SI*) and abnormal short interest (*ABSI(j)*) for firms in the financial misrepresentation sample during the 40-month window around the revelation of financial misrepresentation. *Month 0* is the month in which the financial misrepresentation was publicly revealed. Abnormal short interest ($ABSI(j)_{it}$) for each event firm *i* in month *t* is the difference between the short interest and the predicted short interest using the coefficients in month *t* using model *j*, *j* =1,2,3. The time series means of the coefficients from each model, *j*=1,2,3, are reported in Table III. Short interest (SI_{it}) is the number of shares shorted as a percentage of the number of shares outstanding in month *t*. *N* is the number of firms used in calculating the average for each month in event time. *N* changes due to limited availability of data on short interest or the variables used to calculate abnormal short interest. *t*-statistics test whether *SI* and the *ABSI(j)* differ significantly from zero.

				Model 1			Model 2			Model 3			
Month	SI	N	t-stat	*ABSI(1)*	N	t-stat	*ABSI(2)*	N	t-stat	*ABSI(3)*	N	t-stat	Δ*ABSI(3)*
-19	1.916	245	8.59	0.320	212	1.377	0.137	212	0.62	0.218	179	0.88	
-18	2.254	257	6.97	0.577	219	1.631	0.380	219	1.12	0.528	190	1.37	0.310
-17	2.401	261	7.23	0.695	226	1.999	0.515	226	1.52	0.605	196	1.57	0.077
-16	2.508	275	7.72	0.821	235	2.425	0.644	235	1.99	0.734	207	2.03	0.129
-15	2.463	291	8.45	0.797	245	2.551	0.593	245	1.99	0.682	217	2.04	-0.053
-14	2.603	305	8.89	0.911	260	2.931	0.703	260	2.37	0.857	224	2.51	0.175
-13	2.736	323	8.97	1.067	273	3.234	0.823	273	2.6	0.915	239	2.59	0.058
-12	2.943	319	8.94	1.260	267	3.552	1.062	267	3.12	1.190	234	3.19	0.276
-11	3.178	332	9.61	1.476	277	4.01	1.270	277	3.58	1.374	241	3.51	0.184
-10	3.212	357	10.1	1.512	294	4.195	1.261	294	3.67	1.382	256	3.63	0.008
-9	3.362	361	10.1	1.743	309	4.662	1.443	309	4.03	1.425	262	3.52	0.042
-8	3.419	374	10.2	1.746	323	4.703	1.387	323	3.91	1.399	278	3.57	-0.026
-7	3.362	386	10.7	1.667	336	4.797	1.355	336	4.06	1.417	290	3.8	0.018
-6	3.424	391	11.7	1.646	340	5.187	1.214	340	3.99	1.412	293	4.06	-0.005
-5	3.432	407	11.6	1.719	349	5.302	1.296	349	4.15	1.513	301	4.28	0.101
-4	3.242	411	11.5	1.492	361	4.943	1.132	361	3.94	1.302	310	4.02	-0.211
-3	3.422	410	11.8	1.632	361	5.342	1.247	361	4.23	1.441	314	4.38	0.140
-2	3.564	407	12.4	1.760	364	5.847	1.308	364	4.51	1.449	315	4.48	0.008
-1	**3.743**	**405**	**12.2**	**1.890**	**361**	**5.874**	**1.451**	**361**	**4.68**	**1.651**	**314**	**4.75**	0.203
0	3.815	374	12.3	1.981	313	5.855	1.513	313	4.64	1.682	274	4.62	0.030
1	3.940	324	11.7	2.168	282	5.989	1.379	282	3.9	1.756	241	4.33	0.074
2	4.001	308	11.8	1.966	269	5.821	1.395	269	4.23	1.676	232	4.45	-0.080
3	4.007	300	11.9	2.016	275	5.856	1.489	275	4.47	1.736	233	4.57	0.060
4	3.938	288	11.4	1.936	272	5.543	1.502	272	4.49	1.730	233	4.56	-0.006
5	4.100	286	11.1	2.111	271	5.593	1.638	271	4.44	1.892	231	4.52	0.162
6	4.038	277	10.6	1.669	264	4.732	1.276	264	3.77	1.451	230	3.85	-0.441
7	3.558	276	11.3	1.450	262	4.588	1.099	262	3.66	1.263	228	3.78	-0.189
8	3.456	265	12	1.319	253	4.626	0.949	253	3.45	1.059	222	3.55	-0.204
9	3.313	258	12.1	1.201	249	4.373	0.779	249	2.98	0.897	219	3.19	-0.162
10	3.404	256	12.2	1.318	249	4.732	0.849	249	3.16	1.035	218	3.49	0.138
11	3.446	250	12.1	1.271	243	4.508	0.925	243	3.4	1.046	213	3.53	0.012
12	3.195	251	11.7	1.043	243	3.641	0.677	243	2.42	0.782	211	2.51	-0.264
13	3.171	242	11.3	1.052	234	3.61	0.667	234	2.31	0.762	205	2.4	-0.020
14	3.128	243	11.1	1.059	233	3.745	0.724	233	2.65	0.839	203	2.78	0.077
15	2.929	242	10.7	0.844	236	3.09	0.615	236	2.31	0.747	206	2.54	-0.092
16	2.865	238	10.8	0.743	231	2.802	0.527	231	2.04	0.704	202	2.48	-0.043
17	2.833	235	11.4	0.640	228	2.502	0.337	228	1.34	0.407	201	1.48	-0.298
18	2.891	232	11.3	0.669	225	2.714	0.486	225	2.03	0.557	199	2.13	0.151
19	2.940	227	11.3	0.691	221	2.634	0.496	221	1.94	0.616	196	2.22	0.059
20	2.934	222	10.9	0.751	214	2.681	0.498	214	1.82	0.620	190	2.09	0.003

Table V: Determinants of Abnormal Short Interest at Month -1 Relative to Public Revelation

This table reports the estimates and corresponding *p*-values for cross-sectional regressions that estimate the determinants of abnormal short interest in the month immediately before the month in which financial misrepresentation is revealed to the public:

$$ABSI(j)_{i,-1} = \lambda_0 + \lambda_1 Severity_{i,-1} + \lambda_2 Controls_{i,-1} + \varepsilon_i, \quad j = 1,2,3$$

The sample includes all SEC enforcement actions on NYSE/AMEX/NASDAQ-listed firms for which data on short interest, market capitalization, book-to-market ratio, and momentum are available over the period 1988 through 2005. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under Section 17(a) of the 1933 Securities Act or Section 10 of the 1934 Security Exchange Act. *Insider trading charges* is a dummy variable that equals one if the action includes charges of insider trading. *Total accruals* is based on the measure in Richardson, Sloan, Soliman, and Tuna (2005). *Institutional ownership* is from the CDA/Spectrum database; *Size* is measured by the log of market capitalization; the *Book-to-market ratio* is the ratio of book assets to the sum of book liabilities and the market value of equity; and *Momentum* is calculated as the previous 12-month market-adjusted return.

	Measure of abnormal short interest:											
	Panel A: ABSI(1)				*Panel B: ABSI(2)*				*Panel C: ABSI(3)*			
	1	2	3	4	1	2	3	4	1	2	3	4
Severity measures:												
Fraud	1.650			1.328	1.847			1.547	1.977			1.529
	(0.03)			(0.13)	(0.01)			(0.08)	(0.02)			(0.08)
Insider trading charges		2.034		1.299		1.767		1.046		1.860		1.005
		(0.01)		(0.12)		(0.01)		(0.20)		(0.02)		(0.22)
Total accruals			5.151	4.470			4.650	4.050			4.181	3.601
			(0.00)	(0.00)			(0.00)	(0.01)			(0.00)	(0.01)
Control variables:												
Inst. ownership	0.086	0.089	0.097	0.094	0.070	0.074	0.083	0.079	0.077	0.082	0.082	0.078
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Size	-0.692	-0.727	-0.827	-0.746	-0.582	-0.629	-0.740	-0.651	-0.600	-0.682	-0.729	-0.641
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Book-to-market ratio	0.158	0.159	0.141	0.174	0.136	0.130	0.135	0.168	0.160	0.158	0.140	0.172
	(0.27)	(0.26)	(0.37)	(0.27)	(0.33)	(0.35)	(0.39)	(0.28)	(0.31)	(0.31)	(0.37)	(0.27)
Momentum	0.005	0.003	0.005	0.005	0.006	0.003	0.006	0.006	0.007	0.004	0.006	0.005
	(0.32)	(0.60)	(0.34)	(0.42)	(0.27)	(0.51)	(0.28)	(0.31)	(0.22)	(0.46)	(0.30)	(0.33)
Intercept	0.798	1.702	1.872	0.254	0.258	1.434	1.573	-0.189	0.069	1.428	1.575	-0.159
	(0.46)	(0.04)	(0.04)	(0.83)	(0.81)	(0.08)	(0.08)	(0.87)	(0.95)	(0.12)	(0.08)	(0.89)
n	361	361	315	315	361	361	315	315	314	314	314	314
Adj-R2	0.11	0.12	0.15	0.16	0.09	0.09	0.12	0.13	0.10	0.10	0.11	0.12

Table VI: Short Interest and the Presence or Absence of Financial Misconduct

Each panel groups all firm-months into four cells based on a two-way classification: (i) whether the amount of abnormal short interest is low or high, and (ii) whether the firm subsequently is identified as having misrepresented its financial statements in that month. In Panel A, all firm-months from the beginning of a firm's violation to the end of its enforcement action are included in the "Violation" column. Panel B deletes all firm-months between the public exposure of the violation to the end of the enforcement action. A firm-month is assigned to the *"High ABSI"* group if the firm's abnormal short interest in that month is above the 95th percentile of *ABSI* in the entire cross-section of firms for that month. The table reports results based on our first measure of abnormal short interest, *ABSI(1)*, although similar results obtain for *ABSI(2)* and *ABSI(3)*. The sample includes all NYSE/AMEX/NASDAQ stocks that are in the intersection of CRSP, Compustat, and the short interest dataset.

Panel A:
All firm-months
***"High ABSI"* = 1 if *ABSI* ≥ 95th percentile**

		No Violation	*Violation*	*Total*
Low	Frequency	1024754	17225	1041979
ABSI	Percent	93.42	1.57	94.99
	Row %	98.35	1.65	.
	Column %	95.11	88.22	.
High	Frequency	52658	2299	54957
ABSI	Percent	4.8	0.21	5.01
	Row %	95.82	4.18	.
	Column %	4.89	11.78	.
Total		1077412	19524	1096936
		98.22	1.78	100
Chi-squared statistic:		***1911.66***	***p-value:***	***0***

Panel B:
Excluding months after the enforcement actions begins
***"High ABSI"* = 1 if *ABSI* ≥ 95th percentile**

		No Violation	*Violation*	*Total*
Low	Frequency	1024008	8719	1032727
ABSI	Percent	94.19	0.8	94.99
	Row %	99.16	0.84	.
	Column %	95.04	89.19	.
High	Frequency	53404	1057	54461
ABSI	Percent	4.91	0.1	5.01
	Row %	98.06	1.94	.
	Column %	4.96	10.81	.
Total		1077412	9776	1087188
		99.1	0.9	100
Chi-squared statistic:		***698.08***	***p-value:***	***0***

Table VII: Short Sellers and the Market Penalty for Misrepresentation

This table reports the estimates and corresponding *p*-values for cross-section regressions that estimate the determinants of the market-adjusted abnormal return on the day financial misrepresentation is publicly revealed (AR_i):

$$AR_i = a + f_1\, ABSI(1)_{i,-1} + f_2\, Severity_i + f_3\, Controls_i + e_i,$$

The sample includes all SEC enforcement actions for NYSE/AMEX/NASDAQ-listed firms for which data are available over the period 1988 through 2005. *Abnormal short interest* ($ABSI(1)_{i,-1}$) is actual short interest minus the short interest in a portfolio of firms matched by size, book-to-market ratio, momentum, and industry, measured in the month before public revelation of the misconduct. Results are similar using the alternate measures of abnormal short interest, *ABSI(2)* or *ABSI(3)*. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under Section 17(a) of the 1933 Securities Act or Section 10 of the 1934 Security Exchange Act. *Insider trading charges* is a dummy variable that equals one if the action includes charges of insider trading. *Total accruals* is based on the measure in Richardson, Sloan, Soliman, and Tuna (2005). *Institutional ownership* is from the CDA/Spectrum database; *Size* is measured by the log of market capitalization; the *Book-to-market ratio* is the ratio of book assets to the sum of book liabilities and the market value of equity; and *Momentum* is calculated as the previous 12-month market-adjusted return.

	Models:				
Variables	1	2	3	4	5
Abnormal short interest, $ABSI(1)_{i,-1}$	**-0.314**	**-0.231**	**-0.185**	**-0.191**	**-0.052**
	(0.10)	**(0.23)**	**(0.33)**	**(0.34)**	**(0.79)**
Fraud		-9.695			-7.475
		(0.00)			(0.01)
Insider trading charges			-11.774		-9.050
			(0.00)		(0.00)
Total accruals				-14.850	-11.181
				(0.00)	(0.02)
Institutional ownership	-0.073	-0.056	-0.076	-0.064	-0.052
	(0.15)	(0.26)	(0.12)	(0.22)	(0.30)
Size	1.699	1.367	1.627	1.423	1.059
	(0.00)	(0.01)	(0.00)	(0.02)	(0.08)
Book-to-market ratio	0.047	0.042	0.036	0.035	0.025
	(0.10)	(0.13)	(0.18)	(0.21)	(0.35)
Momentum	-0.012	-0.012	-0.007	-0.012	-0.009
	(0.07)	(0.06)	(0.27)	(0.07)	(0.17)
Intercept	-24.04	-15.42	-21.12	-21.10	-12.31
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	340	340	340	295	295
Adj-R^2	0.04	0.07	0.10	0.05	0.12

Table VIII: Short Selling and the Public Exposure of Financial Misrepresentation

This table reports the coefficients estimates and corresponding *p*-values for the following parametric survival model:

$$\log(M_i) = \beta' X_i + \varepsilon_i .$$

M_i is the month in which firm i's misconduct is revealed to the public. The regression is estimated using data from all months in the violation period through the month of public revelation. X_i includes variables that are likely to affect the exposure of misconduct, most importantly, abnormal short interest. The error term is assumed to follow a logistic distribution. The sample includes all misrepresentations for which data are available over the period 1988 through 2005. Panel A reports the results using the first measure of abnormal short interest, *ABSI(1)*, which is actual short interest minus the short interest in a portfolio of firms matched by size, book-to-market ratio, momentum, and industry. Results are similar using the alternate measures of abnormal short interest, *ABSI(2)* and *ABSI(3)*. Panel B reports results using instrumental variables for each of the three different measures of abnormal short interest. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under Section 17(a) of the 1933 Securities Act or Section 10 of the 1934 Security Exchange Act. *Insider trading charges* is a dummy variable that equals one if the action includes charges of insider trading. *Total accruals* is based on the measure in Richardson, Sloan, Soliman, and Tuna (2005). *Institutional ownership* is from the CDA/Spectrum database; *Size* is measured by the log of market capitalization; the *Book-to-market ratio* is the ratio of book assets to the sum of book liabilities and the market value of equity; and *Momentum* is calculated as the previous 12-month market-adjusted return.

Panel A: Direct tests (using *ABSI(1)* to measure abnormal short interest)

	Models				
	1	2	3	4	5
Abnormal short interest (ABSI(1))	**-0.028**	**-0.025**	**-0.028**	**-0.026**	**-0.023**
	(<0.001)	**(<0.001)**	**(<0.001)**	**(<0.001)**	**(<0.001)**
Fraud		-0.323			-0.480
		(<0.001)			(<0.001)
Insider trading charges			-0.008		0.122
			(0.91)		(0.13)
Total accruals				-0.228	-0.197
				(0.05)	(0.07)
Institutional ownership	-0.0003	-0.0001	-0.0003	-0.0001	0.001
	(0.85)	(0.92)	(0.85)	(0.96)	(0.44)
Size	0.023	0.012	0.023	0.024	-0.004
	(0.16)	(0.47)	(0.16)	(0.19)	(0.83)
Book-to-market ratio	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)
Momentum	0.001	0.001	0.001	0.001	0.001
	(0.05)	(0.03)	(0.05)	(0.05)	(0.04)
Intercept	4.945	5.193	4.947	4.899	5.263
# of observations	8902	8902	8902	7160	7160

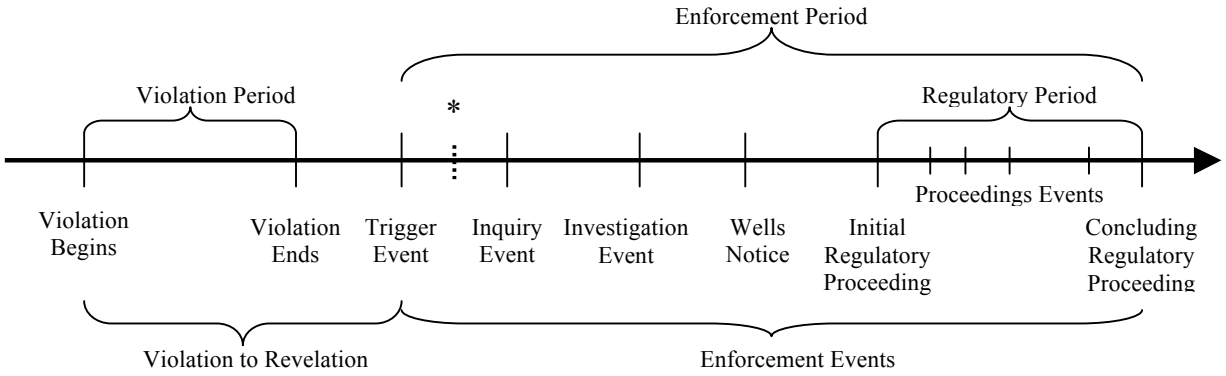
Panel B: Instrumental variable tests

	Abnormal short interest:		
	ABSI(1)	*ABSI(2)*	*ABSI(3)*
Instrumental variable for ABSI(j)	**-0.261**	**-0.206**	**-0.158**
	(0.00)	**(0.00)**	**(0.00)**
Fraud	-0.485	-0.594	-0.540
	(0.00)	(0.00)	(0.00)
Insider trading charges	0.099	0.163	0.154
	(0.20)	(0.05)	(0.08)
Total accruals	-0.490	-0.524	-0.592
	(0.00)	(0.00)	(0.00)
Institutional ownership	0.0020	0.0010	0.0008
	(0.11)	(0.46)	(0.59)
Size	0.052	0.032	0.038
	(0.00)	(0.07)	(0.04)
Book-to-market ratio	-0.0068	-0.0106	-0.0096
	(0.57)	(0.42)	(0.48)
Momentum	0.0015	0.0019	0.0017
	(0.00)	(0.00)	(0.00)
Intercept	4.732	4.986	4.974
# of observations	4922	4922	4922

Table IX: Short Sellers' External Effects on Uninformed Investors

This table reports estimates of the external benefits and costs for uninformed investors from short sellers' trading during the period that the firms' books were in error, using *ABSI(1)* to measure abnormal short interest (n=359). *%Shares sold by the firm and insiders* is the net change in shares outstanding plus net insider sales, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' price impact,* $P_{high} - P_{actual}$, is the difference between the hypothetical price in the absence of abnormal short interest and the actual month-end price, expressed as a percentage of the actual share price at the beginning of the month. *External benefit* is the sum of the monthly estimates of Area B in Figure 4. Each monthly estimate equals the product of the *%Shares sold by the firm and insiders* and *Short sellers' price impact*, and is expressed as a percentage of the firm's equity value. *%New shares created by short sellers* is the increase in *ABSI(1)* from the prior month, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' profit per share,* $P_{actual} - P_{true}$ is the difference between the actual price and the price when news of the misconduct is first revealed to the public, expressed as a percentage of the actual share price at the beginning of the month. *External cost* is the sum of the monthly estimates of Area C in Figure 4. It equals the product of *%New shares created by short sellers* and *Short sellers' profit per share.* The *Net external effect* is the difference between *External benefit* and *External cost*. Each variable is measured in each month of a firm's violation period, and summed over all violation period months. The table reports the mean and median of the cross-section of firm-specific measures and, in brackets, the 95% confidence interval for the mean. t-statistics and confidence intervals are computed from the cross section of firm-specific measures.

	Mean [95% conf. interval]	Median
External benefit:		
% Shares sold by the firm and insiders	45.65 [26.24, 65.06]	8.34
Short sellers' price impact, $P_{high} - P_{actual}$ (% of share price)	2.41 [1.61, 3.21]	0.22
External benefit (sum of monthly estimates of Area B)	1.67 [0.25, 3.09]	0.00
External cost (= short sellers' profits):		
% New shares created by short sellers	1.12 [0.54, 1.70]	0.08
Short sellers' profit per share, $P_{actual} - P_{true}$ (% of share price)	12.13 [2.35, 21.91]	30.44
External cost (sum of monthly estimates of Area C)	0.58 [–0.05, 1.21]	0.08
Net external effect (sum of monthly Area B – Area C):		
Main estimate	1.09 [–0.80, 2.98]	-0.06
Using a lower-bound estimate of external cost	1.53 [0.01, 3.05]	0.00



* The initial filing of a private lawsuit usually occurs soon after the trigger event.

Figure 1: Timeline of a Typical Enforcement Action

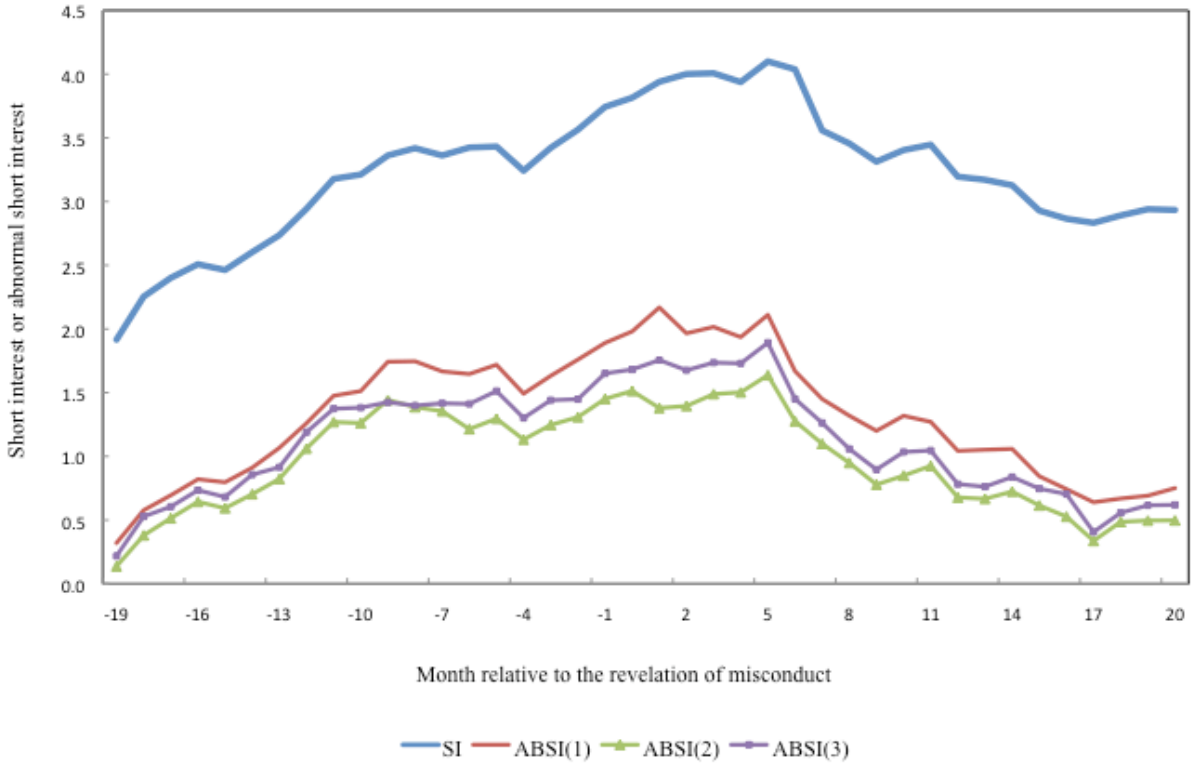


Figure 2: Short Interest around the Revelation of Misconduct

This figure plots the data reported in Table IV, which contains the mean levels of raw and abnormal short interest in the 40-month window around the public revelation of misconduct for the sample of firms targeted in SEC enforcement actions for financial misrepresentation from 1988-2005. Month 0 is the month in which the misrepresentation was first publicly revealed. SI is the mean level of raw short interest. *ABSI(1)*, *ABSI(2)*, and *ABSI(3)* refer to the three different measures of abnormal short interest. Each measure of abnormal short interest equals raw short interest minus the predicted short interest using the model parameters summarized in Table III.

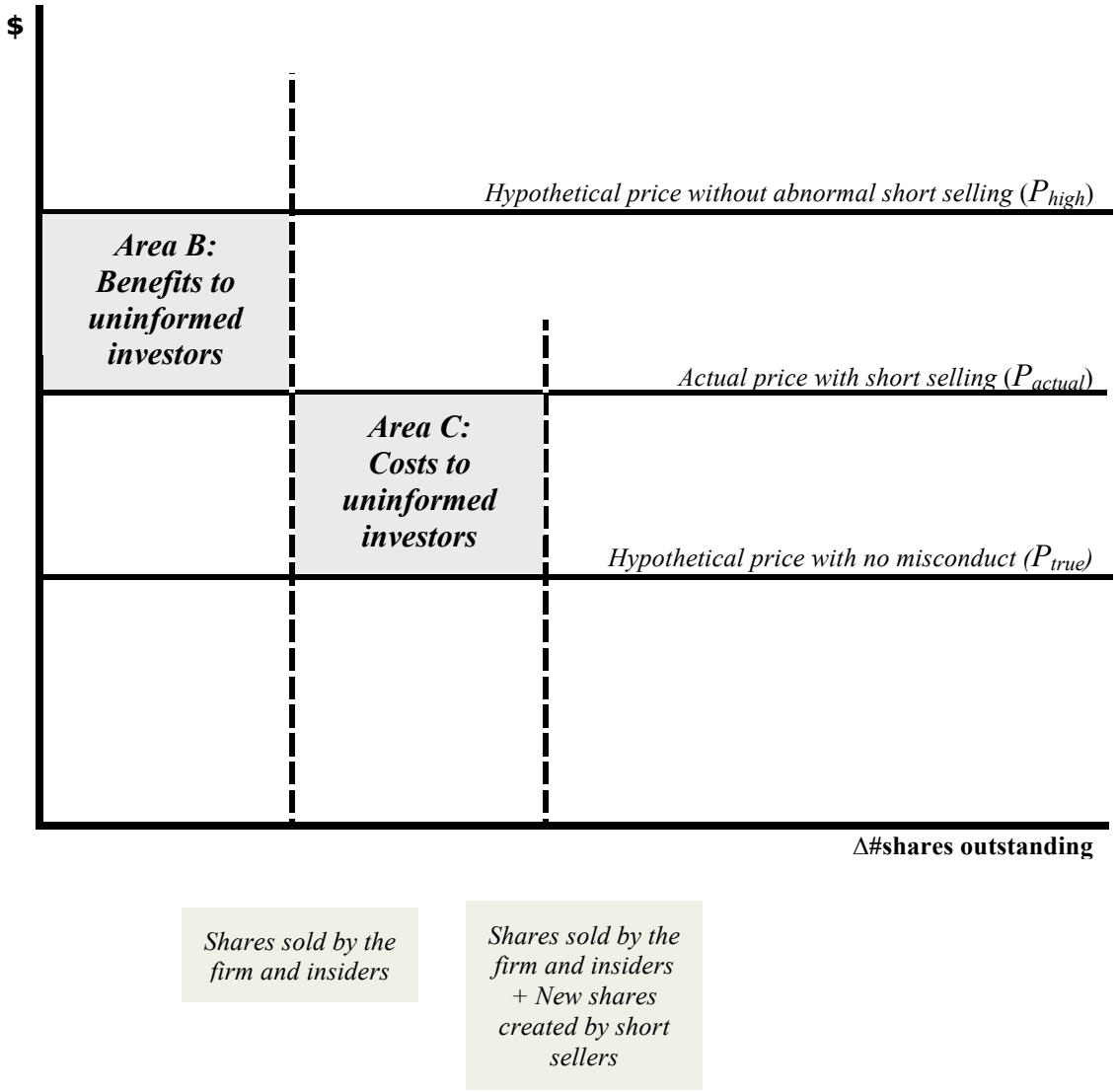


Figure 3: External effects of short sellers on uninformed investors

This figure illustrates two external effects of short sellers on uninformed investors during a period in which the firm's financial statements are in error. The top line (P_{high}) represents the hypothetical price at which shares would trade in a given month *t* if there was no abnormal short selling. It is calculated using a model of monthly share returns with an additional regressor that estimates the marginal impact on monthly returns from abnormal short interest. The middle line (P_{actual}) represents the observed price in the month. The bottom line (P_{true}) represents the hypothetical price at which shares would trade if there was no financial misconduct (or abnormal short selling). *Shares sold by the firm and insiders* is the net change in the number of outstanding shares in month *t* plus the net number of shares sold by insiders in month *t*. *New shares created by short sellers* is the net change in abnormal short interest. Area B represents the external benefits to uninformed investors because abnormal short interest dampens the price inflation during the misconduct period. Area C represents the external cost to uninformed investors due to the additional shares created by short selling, and equals short sellers' profit.

Internet Appendix for "Short Sellers and Financial Misconduct"[1]

Jonathan M. Karpoff and Xiaoxia Lou

This Appendix reports on extensions, sensitivity tests, and goodness-of-fit tests of the results reported in "Short Sellers and Financial Misconduct."

I. A tabular summary of results and contribution

Table IA.I summarizes the tests and results reported in the main paper. The paper raises two main questions, reports on three types of tests for each question, and concludes with a simple answer to each question.

The first question is "Do short sellers detect financial misrepresentation?" In the first test (Table IV and Figure 2 of the paper), we report that abnormal short interest increases steadily in the 19 months before the misconduct is revealed to the public, and subsequently unwinds in the subsequent 20 months. The second test (Table V) reveals that short selling is sensitive to measures of the misconduct severity. The third test (Table VI) reports that short interest concentrates in firm-months in which it subsequently is revealed that the firm was misrepresenting its financial statements. Together, these results indicate that short sellers are proficient at identifying financial misrepresentation before it is publicly revealed. Because we control for short interest driven by firm size, book-to-market, institutional ownership, share turnover, insider selling, and total accruals, we infer that short sellers are not simply basing their positions on such controls. For example, they are not simply chasing accruals. We infer that

[1] Citation format: Jonathan M. Karpoff and Xiaoxia Lou, [2010], Internet Appendix to "Short Sellers and Financial Misconduct," Journal of Finance [vol #], [pages], http://www.afajof.org/IA/[year].asp. Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting information supplied by the authors. Any queries (other than missing material) should be directed to the authors of the article.

short sellers have superior private information or ability to process public information about the financial misconduct. Anecdotes from Einhorn (2008) indicate that at least some short selling before the revelation of financial misconduct is driven by short sellers' ability to process public information.

The second question addressed in the paper is whether short selling generates external costs or benefits for other investors. In our first test of this question (Table VII) we do not find support for one conjecture, which is that short selling imposes external costs because it helps trigger a cascade of selling when bad news is publicly revealed. The second test (Table VIII) reports that short interest is positively related to how quickly the misconduct is revealed to the public. Our point estimate is that the time-to-discovery is shortened by eight months moving from the 25th to the 75th percentile of short interest in month 12 of the violation period. Our third test (Table IX) measures the sizes of the transfers to and from uninformed investors through their price impact. We conclude that short selling has negligible effects on uninformed investors in the median firm. In some firms, however, short sellers generate large savings for uninformed investors, so much so that the average savings is about 1% of the firm's market capitalization.

There is not much overlap between the six main results summarized in Table IA.I and prior research. The largest overlap regards result #1: as discussed in the paper, Dechow, Sloan, and Sweeney (1996), Desai, Krishnamurthy, and Venkataraman (2006), and Efendi, Kinney, and Swanson (2006) all examine short selling before some indicator of financial misconduct, e.g., an earnings restatement. In addition, Desai, Krishnamurthy, and Venkataraman (2006) examine how short selling is related to accruals, which overlaps with our result #2. To our knowledge, the other tests and results have not been considered in previous papers. As argued in section I of the paper, the KLM database also enables tests with greater power than previous tests.

II. The overall pattern of abnormal short selling

Figure IA.1 illustrates the overall pattern of abnormal short selling (using *ABSI(1)*) around both the initiation and discovery of financial misconduct. To construct the Figure, we standardize the period between the initiation and discovery of the misconduct to be 20 pseudo-months for every firm, spreading or compressing each firm's time-to-revelation into 20 intervals of equal length. The resulting pattern shows a build-up of abnormal short interest that begins most noticeably two months before the violation officially begins. Abnormal short interest then grows substantially during the violation period, peaking in the second month after the misrepresentation is publicly revealed. It then decreases until, 20 (actual) months after public discovery, it reaches approximately the same level as immediately before the violation start date.

To explain the build-up of short interest before the violation start date, we conjecture that some violations begin before the dates identified by the SEC as the official start dates. The SEC tends to limit its enforcement activities to firms and periods during which it has substantial evidence of misconduct, so it probably is conservative when it identifies the start of the violation period.

III. On the measurement of abnormal short interest

Our measures of abnormal short interest are based on prior research that shows that short interest is related to such firm characteristics as size, book-to-market, and momentum (e.g., Dechow et al. (2001), Asquith, Pathak, and Ritter (2005), and Duarte, Lou, and Sadka (2008)). Nonetheless, we conducted many tests to examine the reasonableness of our abnormal short interest measures and the robustness of the results.

For example, to calculate the three short interest benchmarks, $E(SI_{it}(j)),\ j = 1, 2, 3,$ we use dummy variables to group firms into three categories for most control variables (e.g., high,

medium, or low book-to-market). *Total accruals* and *insider selling* are measured as continuous variables. The results are not sensitive to the use of dummy variables or continuous measurements for any of our control variables. For example, using continuous variables for each control variable, the results are similar to those reported in the paper. Using a continuous measure for momentum or share turnover, however, yields one interesting result. In the month of a firm's public revelation date, momentum typically is very small (large negative returns) and share turnover typically is very large. Using continuous measures of momentum or share turnover causes large fluctuations in expected short interest in month +1, causing abnormal short interest in month +1 also to be highly variable. The results for all other months are similar to those reported in the tables.

We also examined the sensitivity of the results to different measures of abnormal short interest. Table IA.II reports the results using four alternate measures. The first three differ in the way that expected short interest, $E(SI_{it})$, is defined and measured. In Model 1, $E(SI_{it})$ includes all of the controls as in *ABSI(3)*, plus a control for the dispersion in analysts' forecasted earnings. Data on analysts' forecasts, which are from I/B/E/S, limit the sample size. But the results are similar to those in Table IV in the paper.

In Model 2, $E(SI_{it})$ includes all of the controls as in *ABSI(1)* plus a control for the level of short interest before the violation period. Each firm in the sample is paired with a single benchmark firm. The benchmark firm is the one firm in the same size, book-to-market, momentum, and industry portfolio that has short interest closest to that of the sample firm in the month before the start of the violation period. Abnormal short interest in any month *t* is the difference between the sample firm's short interest and that of its matched control firm. In Model 3, $E(SI_{it})$ is defined as the sample firm's mean level of short interest measured in the

month before the beginning of its violation period. The results from Models 1 through 3 all are similar to those reported in the paper using *ABSI(j)*, j=1,2,3.

In Model 4, abnormal short interest is defined as a binary variable, *D(ABSI)*, similar to the notion used by Dyck, Morse, and Zingales (2008). *D(ABSI)* is set equal to one if it exceeds the firm's average short interest in the 12 months before its violation period by at least three standard deviations (standard deviation is measured in the same 12-month pre-violation period). The numbers reported in the table are the fraction of firms in each event month *t* for which *D(ABSI)* = 1. The p-values are from a chi-squared test with one degree of freedom of the null hypothesis that the fraction of firms for which *D(ABSI)* = 0 equals or is less than 0.15%, which is the probability that a variable with the normal distribution falls more than three standard deviation above the mean.

All four alternate measures yield similar inferences. In each case, abnormal short interest builds during the 19 months before public revelation of the misconduct. It is positive and statistically significant in months –1 and 0, peaks shortly after the month of public revelation, and winds down in the following months.

IV. Abnormal returns and misconduct severity

Table IA.III shows that our three primary measures of misconduct severity (*Fraud, Insider trading charges, and Total accruals*) are negatively and significantly related to the one-day abnormal stock return on the day of initial public revelation. This is consistent with the premise that each is a good proxy for the severity of misconduct. If these variables are thought of as instruments for the abnormal stock return, then Table IA.III indicates that the instruments meet the relevance exclusion for a good instrumental variable.

V. Additional measures of misconduct severity

Table IA.IV is similar to Table V in the paper, except that we introduce four additional measures of misconduct severity. The first, *Regulatory fines*, is the size of the regulatory fine imposed on the firm for financial misrepresentation. The second, *Private lawsuit award*, is the size of the settlement if the misrepresentation prompted a private securities class action lawsuit. The third, *Non-monetary penalties*, is Karpoff, Lee, and Martin's (2009) index of non-monetary regulatory sanctions for financial misconduct. Data for all three are from the KLM database.

The results using *Regulatory fines* or *Private lawsuit award* are similar to those reported in the paper, indicating that $ABSI(j)_{i,-1}$ is positively related to the severity of the misconduct. In contrast, $ABSI(j)_{i,-1}$ is not significantly related to *Non-monetary penalties*. This is consistent with findings reported by Karpoff, Lee, and Martin (2009) that non-monetary sanctions are a relatively noisy measure of misconduct severity. Notice that, when these three additional measures are included, as in Model 4, our three main measures of severity all are positively and significantly related to $ABSI(j)_{i,-1}$.

The fourth additional measure of misconduct severity is a dummy variable that equals one if the firm subsequently declares bankruptcy during its enforcement period. Karpoff, Lee, and Martin (2008b) find that the firm's reputation loss is both large and positively related to the severity of the misconduct. This suggests that egregious violations are more likely to impose such large losses on the firm as to trigger bankruptcy, and so *Bankruptcy* is a measure of the severity of the misconduct. Consistent with this conjecture, short interest in month –1 is larger for bankruptcy firms than for non-bankruptcy firms.

A referee pointed out that Campbell, Hilscher, and Szilagy (*The Journal of Finance*, December 2008) find that financially distressed stocks have abnormally low returns, and suggested that the short selling we measure might anticipate poor performance, not financial

misconduct – or that it anticipates financial misconduct and not the subsequent poor performance. To examine this issue we partitioned the sample into firms that subsequently declared bankruptcy and those that did not. Abnormal short interest is higher in the bankruptcy group, but the build-up before public revelation is positive and statistically significant in both groups. This indicates that abnormal short interest is driven at least in part by financial misrepresentation. We have not investigated the firm characteristics that lead to bankruptcy, so we cannot address whether any short selling before bankruptcy is actually due to financial misconduct. A broader inquiry into this issue would need to examine the relationships between short selling, financial performance, misconduct, and bankruptcy.

VI. The relation between misconduct severity and the build-up of short interest

Table V in the paper reports how short interest in the month before public revelation is positively related to the severity of the misconduct. We also examined how the *change* in abnormal short interest from month -19 to month -1 is related to the severity of the misconduct. Specifically, we estimate the following equation:

$$\Delta ABSI(j)_{i,[-19,-1]} = \gamma_0 + \gamma_1 Severity_{i,-1} + \gamma_2 Controls_{i,-1} + e_i, j = 1,2,3 \qquad (6)$$

The results are reported in Table IA.V. All three proxies are positively related to the cumulative change in abnormal short interest. The coefficients for *Fraud* and *Total accruals* are statistically significant, both when considered separately and when all three proxies are considered together, as in Model 4.

Overall, the results in Tables V and IA.V indicate that short interest is positively related to the severity of the misrepresentation that subsequently is revealed to the public. Short sellers not only pre-identify firms that get into trouble for misrepresenting their financial statements.

They also take larger positions when the misrepresentation is particularly egregious. That is, short sellers appear to anticipate both the existence and severity of financial misrepresentation.

VII. Stock returns after public revelation

We also examined the stock price behavior after the initial disclosure of misconduct. If short selling causes overreaction – either in the short term or long term – then we should see differences in the stock price paths of our sample firms that correspond to differences in short interest. The results, however, do not support an overreaction story.

Figure IA.II reports a representative test. The blue (upper) line represents the cumulative abnormal one-day abnormal stock return for the portfolio of sample firms with lower-than-average *ABSI(1)* in month –1. The gray (lower) line represents the cumulative return for firms with higher-than-average *ABSI(1)*. The abnormal return on the day of public revelation is more negative for the high-*ABSI(1)* group. This is consistent with our findings that abnormal short interest is positively related to misconduct severity, and severity is related to the magnitude of the stock price drop on day 0. After day 0, however, the longer-term abnormal returns are not significantly different from each other, nor are they significantly different from zero. There is no price reversal after day 0 in either group.

VIII. Sensitivity test for Table VII results

Table IA.VI reports a variation of the test reported in Table VI of the paper. In Table VI, we define "high short interest" to consist of firm-months in which abnormal short interest is in the top 5% of the distribution of abnormal short interest. In Table IA.VI, we use a top 10% threshold to categorize firms into the "high short interest" group. The results are similar to those in Table VI. For example, in Panel A of Table IA.VI, $\chi^2 = 2877$ with a p-value = 0.00. (Using

still lower thresholds, e.g., the top 25%, yields similar results.) These results indicate that short interest concentrates in firm-months that subsequently are revealed to have financial misrepresentation.

IX. Short interest and the time to revelation

We conducted several goodness-of-fit tests for the model used to estimate equation (8) in the paper, as described by Cleves et al. (2004). In some specifications, we find that the time-to-revelation is positively related to T_{it}, the number of months since the start of the violation. This indicates that the probability of uncovering misconduct in any given month t is negatively related to how long the misconduct has been going on. The time-to-revelation also is positively related to the interaction of T_{it} and abnormal short interest. This indicates that the impact of short interest on the speed with which misconduct is discovered decreases with T_{it}. The coefficient for this interaction term, however, is small, so that the overall impact of short interest is to hasten the time to discovery. In all of the sensitivity tests we conducted, the coefficient for abnormal short interest remains negative and statistically significant.

X. Alternate Estimates of the Net External Benefits

Table IX in the paper reports estimates of the external effects on uninformed investors via short sellers' impact on prices during the violation period, using *ABSI(1)* to measure abnormal short interest. Table IA.VII reports similar estimates based on *ABSI(2)* and *ABSI(3)*. The results are similar using these other two measures of abnormal short interest. Depending on the specific measure of abnormal short interest, short sellers generate external benefits for uninformed traders that average between 1.12% and 1.67% of equity value. But these benefits are concentrated in a small number of firms and they are negligible for the median firm. Short

sellers make profits on their trades that average between 0.36% and 0.94% of the firm's equity value, leaving a net external benefit of between 0.19% and 1.09% of the firm's equity value. If we use a lower-bound estimate of short sellers' external costs, the measures of net benefit increase to between 0.89% and 1.53% of equity value. The overall conclusions remain the same: short sellers generate external benefits, which in the median case they internalize with their trading profits. For a small number of firms, however, the external benefits are large, indeed, large enough to affect the mean estimates. Short sellers generate net external benefits particularly when they take positions in misrepresenting firms that issue new (overpriced) shares to uninformed investors.

XI. Insider trading and abnormal short interest

A referee made the following suggestion:

"One possible interpretation of these results is that some insiders know of the misrepresentation and the likelihood of an investigation, and they short sell shares of their own firm to profit from this knowledge. This idea is supported empirically in Agrawal and Cooper (2008). Could it be the case that firms investigated for insider trading are more likely to have insider short selling, because of a disregard for insider trading rules that is associated with the culture of the firm? … One conjecture … is that short selling happens earlier for insider trading firms, perhaps before the 19 month cutoff. It might be worth displaying the pattern of short interest separately for each type of misconduct to see if insider trading firms have a different pattern of timing, especially early on."

Following the referee's suggestion, Figure IA.III partitions the sample into two groups with high and low insider selling. Abnormal short interest is relatively high for the high insider

selling group in some event-months, but not before month –13. In the early months, abnormal short interest is slightly higher in the low insider selling group. This graph plots the third measure of abnormal short interest ABSI(3), although the results are similar using ABSI(1) or ABSI(2).

Table IA.I
Summary of main questions, tests, and results

Question:	Do short sellers detect financial misrepresentation?	Do they convey external benefits or costs on other investors?
Findings:	1. Abnormal short interest increases steadily before the misconduct is revealed to the public. 2. Abnormal short interest is positively related to the severity of the misconduct. 3. Abnormal short interest in general concentrates in firm-months with misrepresentation.	4. High short interest does not trigger a large price drops when the misconduct is revealed. 5. Short interest is related to how quickly the misconduct is discovered by the public. 6. Short sellers' price impact saves uninformed investors save roughly 1% of market cap during the violation period.
Inference:	Yes.	External benefits.

Table IA.II: Alternative Measures of Abnormal Short Interest

The table reports the abnormal short interest in the 30 months around the public revelation of financial misconduct using four alternative measures of abnormal short interest. In Model 1, normal short interest is calculated using all the controls in Model 3 of Table III, plus a control for the dispersion in analysts' forecasted earnings. In Model 2, normal short interest is the short interest of the one firm in the same size, book-to-market, momentum, and industry portfolio that has the short interest level closest to that of the sample firm in the month before the start of the violation period. In Model 3, normal short interest is the sample firm's own level of short interest measured in the month before the start of the violation period. In Model 4, normal short interest is measured as the firm's mean short interest in the 12 months before its violation period plus three times the standard deviation of short interest over the same period. If a firm's short interest exceeds normal short interest, then *D(ABSI)* takes the value of one, and zero otherwise. The first column under Model 4 reports the fraction of firms for which *D(ABSI)* equals one. The p-value is from a chi-square test with one degree of freedom for the null hypothesis that this fraction exceeds 0.15%, which is the probability that a variable with the normal distribution falls three standard deviations above the mean.

	Model 1			Model 2			Model 3			Model 4		
Month	*ABSI*	N	t-stat	*ABSI*	N	t-stat	*ABSI*	N	t-stat	*D(ABSI)*	N	P-value
-19	0.367	118	0.98	0.455	138	1.32	0.328	196	1.57	0.302	189	<.0001
-18	0.487	125	1.31	0.476	140	1.36	-0.047	205	-0.10	0.320	197	<.0001
-17	0.599	126	1.59	0.506	139	1.38	0.128	205	0.27	0.354	198	<.0001
-16	0.788	130	2.25	0.638	149	1.94	0.208	219	0.44	0.357	210	<.0001
-15	0.669	138	2.17	0.645	154	2.21	0.196	233	0.45	0.368	223	<.0001
-14	1.086	140	3.22	0.589	158	2.23	0.192	245	0.46	0.374	235	<.0001
-13	1.143	151	3.07	0.779	165	2.84	0.384	258	0.95	0.375	248	<.0001
-12	1.439	145	3.38	0.753	161	2.52	0.465	253	1.11	0.383	243	<.0001
-11	1.685	153	3.75	0.978	170	2.97	0.789	264	1.87	0.425	254	<.0001
-10	1.622	164	3.70	0.768	181	2.42	0.842	279	2.07	0.414	268	<.0001
-9	1.623	169	3.57	0.838	180	2.59	0.964	280	2.30	0.409	269	<.0001
-8	1.572	187	3.69	0.869	186	2.69	0.954	289	2.33	0.403	278	<.0001
-7	1.607	190	3.72	0.974	192	3.02	1.022	299	2.51	0.392	288	<.0001
-6	1.791	200	4.08	1.018	191	3.05	1.019	300	2.45	0.408	289	<.0001
-5	1.981	200	4.44	0.974	195	2.87	1.096	307	2.64	0.409	296	<.0001
-4	1.771	203	4.16	0.915	194	2.69	0.910	310	2.22	0.397	300	<.0001
-3	1.844	210	4.08	0.963	194	2.71	1.052	308	2.52	0.399	298	<.0001
-2	1.722	207	3.93	0.804	188	2.27	1.175	306	2.73	0.434	295	<.0001
-1	**2.073**	**210**	**4.50**	**0.889**	**189**	**2.43**	**1.218**	**303**	**2.80**	0.416	**293**	**<.0001**
0	2.132	194	4.27	1.132	172	2.59	1.178	267	2.47	0.446	258	<.0001
1	2.079	171	3.80	1.183	151	3.07	1.253	241	2.58	0.440	234	<.0001
2	1.927	167	3.79	1.077	145	2.82	1.242	233	2.59	0.446	224	<.0001
3	1.913	162	3.85	0.917	142	2.21	1.114	230	2.35	0.439	221	<.0001
4	1.932	157	3.70	0.825	141	1.81	0.971	221	1.90	0.420	212	<.0001
5	1.880	156	3.50	0.782	140	1.53	1.086	217	1.94	0.438	208	<.0001
6	1.463	151	2.77	0.604	136	1.18	0.725	213	1.32	0.425	207	<.0001
7	0.979	143	2.25	0.425	139	0.91	0.535	211	0.97	0.400	205	<.0001
8	0.721	139	1.97	0.357	136	0.76	0.283	205	0.51	0.417	199	<.0001
9	0.685	136	1.89	0.35	134	0.73	0.233	202	0.42	0.408	196	<.0001
10	0.648	137	1.65	0.276	132	0.55	0.287	202	0.51	0.405	195	<.0001

Table IA.III: Abnormal Stock Returns and Misconduct Severity

The market-adjusted one-day return on the day the misconduct was publicly revealed is regressed on the three main measures of misconduct severity: *Fraud, Insider Trading Charges,* and *Total Accruals*.

$$AR_i = a + b_1 Severity_i + b_2 Controls_i + e_i$$

All independent variables are measured at the end of the month prior to the revelation of misconduct. This table reports the estimates and corresponding p-value for the cross-section regressions.

	1	2	3	4
Severity measures:				
Fraud	-9.655			-7.862
	(0.00)			(0.00)
Insider trading charges		-11.21		-9.782
		(0.00)		(0.00)
Total accruals			-7.257	-6.340
			(0.02)	(0.16)
Control variables:				
Inst. ownership	-0.078	-0.096	-0.082	-0.074
	(0.09)	(0.03)	(0.10)	(0.10)
Size	1.384	1.603	1.321	1.172
	(0.01)	(0.00)	(0.03)	(0.03)
Book-to-market ratio	0.341	0.283	0.273	0.157
	(0.49)	(0.56)	(0.62)	(0.38)
Momentum	-0.012	-0.008	-0.012	-0.006
	(0.07)	(0.26)	(0.09)	(0.40)
Intercept	-14.75	-20.20	-20.70	-12.17
	(0.00)	(0.00)	(0.00)	(0.00)
n	355	355	287	273
Adj-R2	0.064	0.081	0.028	0.110

Table IA.IV: Additional Measures of Misconduct Severity

This table reports the estimates and corresponding *p*-values from cross-sectional regressions that estimate the determinants of abnormal short interest before the financial misrepresentation is publicly revealed, using four additional measures of misconduct severity:

$$ABSI(j)_{i,-1} = \gamma_0 + \gamma_1 Severity_{i,-1} + \gamma_2 Controls_{i,-1} + e_i, j = 1,2,3$$

All variables are measured in the month before the misrepresentation is publicly revealed. *Regulatory fines* is the logarithm of one plus the size of the regulatory fines imposed on the firm for financial misrepresentation. *Private lawsuit award* is the logarithm of one plus the size of the settlement if the misrepresentation prompted a private securities class action lawsuit. *Non-monetary penalties* is the logarithm of one plus the Karpoff, Lee, and Martin's (2009) index of non-monetary regulatory sanctions for financial misconduct. *Bankruptcy* is a dummy variable that equals one if the firm filed for bankruptcy before the end of its enforcement period.

	ABSI(1)					ABSI(2)					ABSI(3)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Severity measures:															
Regulatory fines	0.142			0.153		0.136			0.151		0.145			0.152	
	(0.01)			(0.02)		(0.01)			(0.02)		(0.01)			(0.02)	
Private lawsuit award		0.102		0.026			0.089		0.020			0.082		0.014	
		(0.01)		(0.59)			(0.02)		(0.66)			(0.06)		(0.76)	
Non-monetary penalties			0.069	-1.445				0.022	-1.464				-0.017	-1.476	
			(0.83)	(0.00)				(0.95)	(0.00)				(0.96)	(0.00)	
Bankruptcy					2.172					2.044					1.916
					(0.00)					(0.00)					(0.01)
Fraud				1.866					2.138					2.152	
				(0.06)					(0.03)					(0.03)	
Insider Trading				1.822					1.608					1.597	
				(0.04)					(0.07)					(0.07)	
Total accruals				4.635					4.263					3.856	
				(0.00)					(0.00)					(0.01)	
Control variables:															
Institutional ownership	0.087	0.084	0.090	0.092	0.090	0.072	0.069	0.074	0.078	0.074	0.079	0.078	0.082	0.077	0.082
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Size	-0.839	-0.812	-0.758	-0.825	-0.661	-0.734	-0.703	-0.656	-0.722	-0.564	-0.788	-0.757	-0.697	-0.709	-0.618
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Book-to-market ratio	0.088	0.149	0.130	0.143	0.144	0.065	0.121	0.104	0.138	0.118	0.095	0.142	0.134	0.143	0.136
	(0.53)	(0.29)	(0.36)	(0.36)	(0.30)	(0.64)	(0.38)	(0.45)	(0.37)	(0.39)	(0.55)	(0.36)	(0.40)	(0.35)	(0.38)
Momentum	0.005	0.006	0.005	0.003	0.006	0.005	0.006	0.005	0.004	0.006	0.006	0.007	0.006	0.003	0.007
	(0.38)	(0.28)	(0.37)	(0.61)	(0.26)	(0.33)	(0.25)	(0.32)	(0.49)	(0.22)	(0.31)	(0.22)	(0.29)	(0.53)	(0.23)
Intercept	1.522	1.919	2.208	1.571	1.091	1.203	1.621	1.954	1.133	0.812	1.122	1.684	2.027	1.161	0.975
	(0.07)	(0.02)	(0.04)	(0.22)	(0.22)	(0.15)	(0.04)	(0.06)	(0.37)	(0.35)	(0.23)	(0.06)	(0.08)	(0.36)	(0.31)
n	361	361	361	315	361	361	361	361	315	361	314	314	314	314	314
Adj-R2	0.12	0.12	0.10	0.18	0.128	0.09	0.09	0.07	0.16	0.098	0.10	0.10	0.08	0.15	0.104

Table IA.V: Determinants of the Change in Short Interest Over Months [-19,-1]

This table reports the estimates and corresponding *p*-values from cross-sectional regressions that estimate the determinants of the change in abnormal short interest before the financial misrepresentation is publicly revealed:

$$\Delta ABSI(j)_{i,[-19,-1]} = \gamma_0 + \gamma_1 Severity_{i,-1} + \gamma_2 Controls_{i,-1} + e_i, j = 1,2,3$$

The change is measured from month -19 through month -1 relative to the month in which the misrepresentation is publicly revealed. The sample includes all SEC enforcement actions on NYSE/AMEX/NASDAQ-listed firms for which data are available over the period 1988 through 2005. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under Section 17(a) of the 1933 Securities Act or Section 10 of the 1934 Security Exchange Act. *Insider trading charges* is a dummy variable that equals one if the action includes charges of insider trading. Variable *Total accruals* is based on the measure in Richardson, Sloan, Soliman, and Tuna (2005). *Institutional ownership* is from the CDA/Spectrum database; *Size* is measured by the log of market capitalization; the *Book-to-market ratio* is the ratio of book assets to the sum of book liabilities and the market value of equity; and *Momentum* is calculated as the previous 12-month market-adjusted return.

	Measure of abnormal short interest:											
	Panel A: ΔABSI(1)				*Panel B: ΔABSI(2)*				*Panel C: ΔABSI(3)*			
	1	2	3	4	1	2	3	4	1	2	3	4
Severity measures:												
Fraud	1.550			1.510	1.873			1.836	1.885			1.769
	(0.03)			(0.07)	(0.01)			(0.02)	(0.01)			(0.02)
Insider trading charges		1.156		0.596		1.067		0.404		0.875		0.160
		(0.11)		(0.47)		(0.13)		(0.61)		(0.25)		(0.84)
Total accruals			2.636	2.171			2.684	2.264			2.903	2.603
			(0.12)	(0.20)			(0.10)	(0.17)			(0.07)	(0.11)
Control variables:												
Inst. ownership	0.021	0.024	0.033	0.028	0.016	0.019	0.030	0.024	0.029	0.033	0.034	0.029
	(0.11)	(0.07)	(0.02)	(0.05)	(0.22)	(0.14)	(0.04)	(0.08)	(0.04)	(0.02)	(0.01)	(0.04)
Size	-0.238	-0.273	-0.378	-0.293	-0.194	-0.241	-0.379	-0.281	-0.250	-0.327	-0.382	-0.292
	(0.11)	(0.07)	(0.03)	(0.10)	(0.18)	(0.10)	(0.03)	(0.10)	(0.13)	(0.05)	(0.02)	(0.08)
Book-to-market ratio	-0.132	-0.149	-0.190	-0.152	-0.071	-0.095	-0.133	-0.090	-0.083	-0.118	-0.129	-0.089
	(0.39)	(0.33)	(0.24)	(0.35)	(0.64)	(0.53)	(0.40)	(0.57)	(0.59)	(0.44)	(0.40)	(0.56)
Momentum	0.003	0.002	0.003	0.003	0.006	0.005	0.005	0.006	0.006	0.005	0.005	0.006
	(0.54)	(0.68)	(0.64)	(0.57)	(0.27)	(0.39)	(0.34)	(0.27)	(0.25)	(0.40)	(0.40)	(0.31)
Intercept	0.325	1.369	1.638	0.048	-0.250	1.109	1.438	-0.411	-0.519	1.025	1.223	-0.477
	(0.75)	(0.10)	(0.07)	(0.97)	(0.80)	(0.17)	(0.10)	(0.71)	(0.64)	(0.25)	(0.16)	(0.67)
n	261	261	228	228	261	261	228	228	223	223	223	223
Adj-R2	0.02	0.01	0.02	0.03	0.03	0.01	0.02	0.04	0.04	0.02	0.03	0.05

Table IA.VI: Short Interest and the Presence or Absence of Financial Misconduct

Each panel groups all firm-months into four cells based on a two-way classification: (i) whether the amount of abnormal short interest is low or high, and (ii) whether the firm subsequently is identified as having misrepresented its financial statements in that month. In Panel A, all firm-months from the beginning of the violation to the end of the enforcement action are included in the "Violation" column. Panel B deletes all firm-months between the public exposure of the violation to the end of the enforcement action. A firm-month is assigned to the *"High ABSI"* group if the firm's abnormal short interest in that month is above the 90th percentile of *ABSI* in the entire cross-section of firms for that month. The table reports results based on our first measure of abnormal short interest, *ABSI(1)*, although results are similar for *ABSI(2)* and *ABSI(3)*. The sample includes all NYSE/AMEX/NASDAQ stocks that are in the intersection of CRSP, Compustat, and the short interest dataset.

Panel A:
All firm-months
***"High ABSI"* = 1 if *ABSI* ≥ 90th percentile**

		No Violation	*Violation*	*Total*
Low	Frequency	971797	15341	987138
ABSI	Percent	88.59	1.4	89.99
	Row %	98.45	1.55	.
	Column %	90.2	78.58	.
High	Frequency	105615	4183	109798
ABSI	Percent	9.63	0.38	10.01
	Row %	96.19	3.81	.
	Column %	9.8	21.42	.
Total		1077412	19524	1096936
		98.22	1.78	100
Chi-squared statistic:		***2876.68***	***p-value:***	***0***

Panel B:
Excluding months after the enforcement actions begins
***"High ABSI"* = 1 if *ABSI* ≥ 90th percentile**

		No Violation	*Violation*	*Total*
Low	Frequency	970616	7752	978368
ABSI	Percent	89.28	0.71	89.99
	Row %	99.21	0.79	.
	Column %	90.09	79.3	.
High	Frequency	106796	2024	108820
ABSI	Percent	9.82	0.19	10.01
	Row %	98.14	1.86	.
	Column %	9.91	20.7	.
Total		1077412	9776	1087188
		99.1	0.9	100
Chi-squared statistic:		***1252.56***	***p-value:***	***0***

Table IA.VII: Short Sellers' External Effects on Uninformed Investors

This table reports estimates of short sellers' external benefits and costs for uninformed investors, similar to Table IX in the paper, using *ABSI(2)* and *ABSI(3)* to measure abnormal short interest. *%Shares sold by the firm and insiders* is the net change in shares outstanding plus net insider sales, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' price impact,* $P_{high} - P_{actual}$, is the difference between the hypothetical price in the absence of abnormal short interest and the actual month-end price, expressed as a percentage of the actual share price at the beginning of the month. *External benefit* is the sum of the monthly estimates of Area B in Figure 4. Each monthly estimate equals the product of the *%Shares sold by the firm and insiders* and *Short sellers' price impact*, and is expressed as a percentage of the firm's equity value. *%New shares created by short sellers* is the increase in *ABSI(j)*, j=1,2,3 from the prior month, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' profit per share,* $P_{actual} - P_{true}$ is the difference between the actual price and the price when news of the misconduct is first revealed to the public, expressed as a percentage of the actual share price at the beginning of the month. *External cost* is the sum of the monthly estimates of Area C in Figure 4. It equals the product of *%New shares created by short sellers* and *Short sellers' profit per share.* The *Net external effect* is the difference between *External benefit* and *External cost*. Each variable is measured in each month of a firm's violation period, and summed over all violation period months. The summary measures report the mean and median of the cross-section of firm-specific measures. The t-statistic is computed from the cross section of firm-specific measures.

Panel A: Using ABSI(2) to measure abnormal short interest (n = 359)

	Mean	t-stat	Median
% Shares sold by the firm and insiders	45.65	4.61	8.34
Short sellers' price impact, $P_{high} - P_{actual}$ (% of share price)	1.93	5.84	0.11
% External benefit (sum of monthly estimates of Area B)	1.12	2.15	0.00
% New shares created by short sellers	0.75	2.51	0.07
Short sellers' profit per share, $P_{actual} - P_{true}$ (% of share price)	12.13	2.43	30.44
% External cost (sum of monthly estimates of Area C)	0.36	1.12	0.06
Net external effect (sum of monthly Area B – Area C)	0.76	0.99	0.00
Net external effect using a lower-bound estimate of external cost	1.03	1.79	0.00

Panel B: Using ABSI(3) to measure abnormal short interest (n = 307)

	Mean	t-stat	Median
% Shares sold by the firm and insiders	49.96	4.34	10.33
Short sellers' price impact, $P_{high} - P_{actual}$ (% of share price)	1.97	5.56	0.09
% External benefit (sum of monthly estimates of Area B)	1.12	2.07	0.00
% New shares created by short sellers	0.80	2.54	0.09
Short sellers' profit per share, $P_{actual} - P_{true}$ (% of share price)	10.95	1.91	30.77
External cost (sum of monthly estimates of Area C)	0.94	3.08	0.08
Net external effect (sum of monthly Area B – Area C)	0.19	0.38	-0.01
Net external effect using a lower-bound estimate of external cost	0.89	1.73	0.00

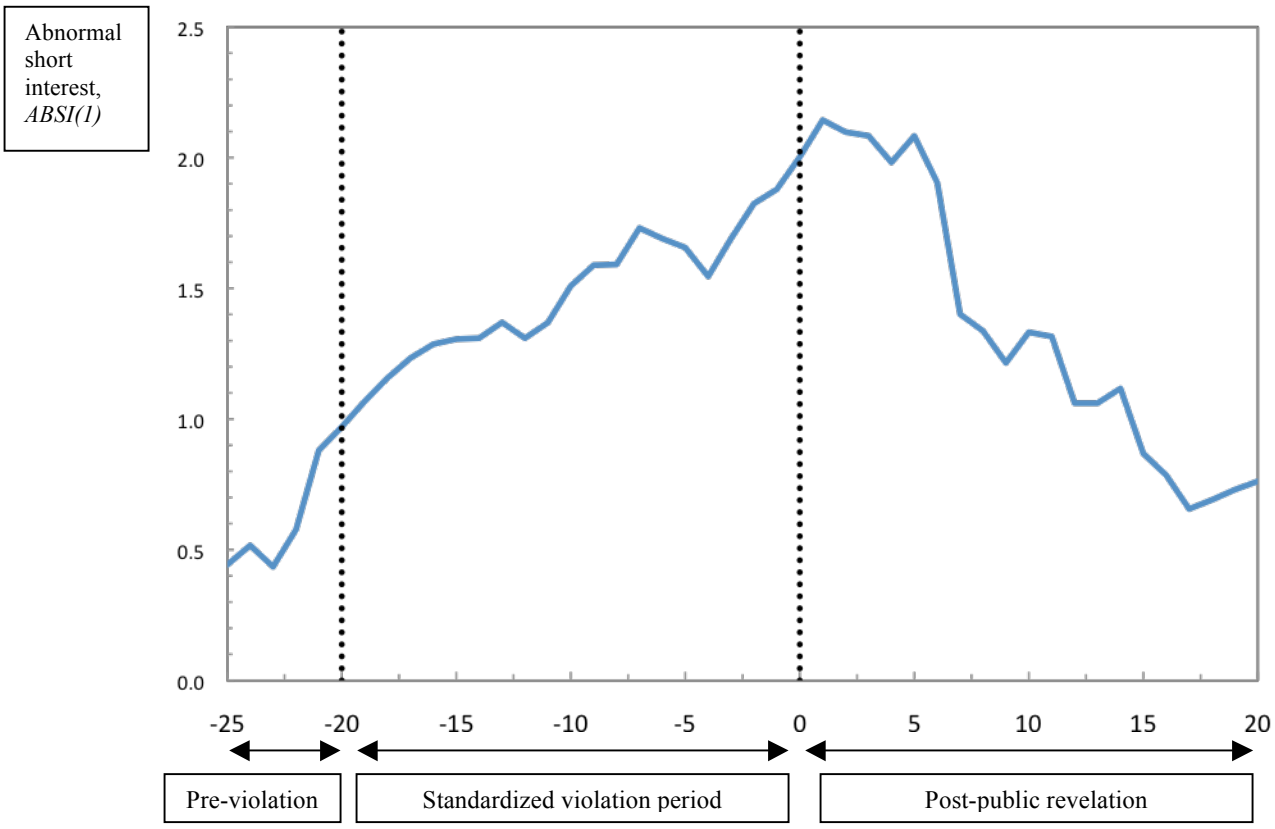


Figure IA.I: Stylized Pattern of Abnormal Short Interest

This figure reflects the pattern of abnormal short interest around the beginning of the violation period and the public revelation of financial misconduct. Because different firms' time to public discovery differ, we partition the period from the violation start to the public revelation into 21 pseudo-months (the period -20, 0) for all firms. The actual number of days in a pseudo-month differs across firms, such that all firms have exactly 20 pseudo-months. Month -20 is defined as the month in which the misrepresentation began, and Month 0 is when the misrepresentation was publicly revealed. The sample includes all NYSE/AMEX/NASDAQ-listed firms targeted in SEC enforcement actions for financial misrepresentation from 1988-2005 for which data on short interest, market capitalization, the book-to-market ratio, and momentum are available. This figure reports the results using our first measure of short interest, *ABSI(1)*, but the results are similar using *ABSI(2)* or *ABSI(3)*.

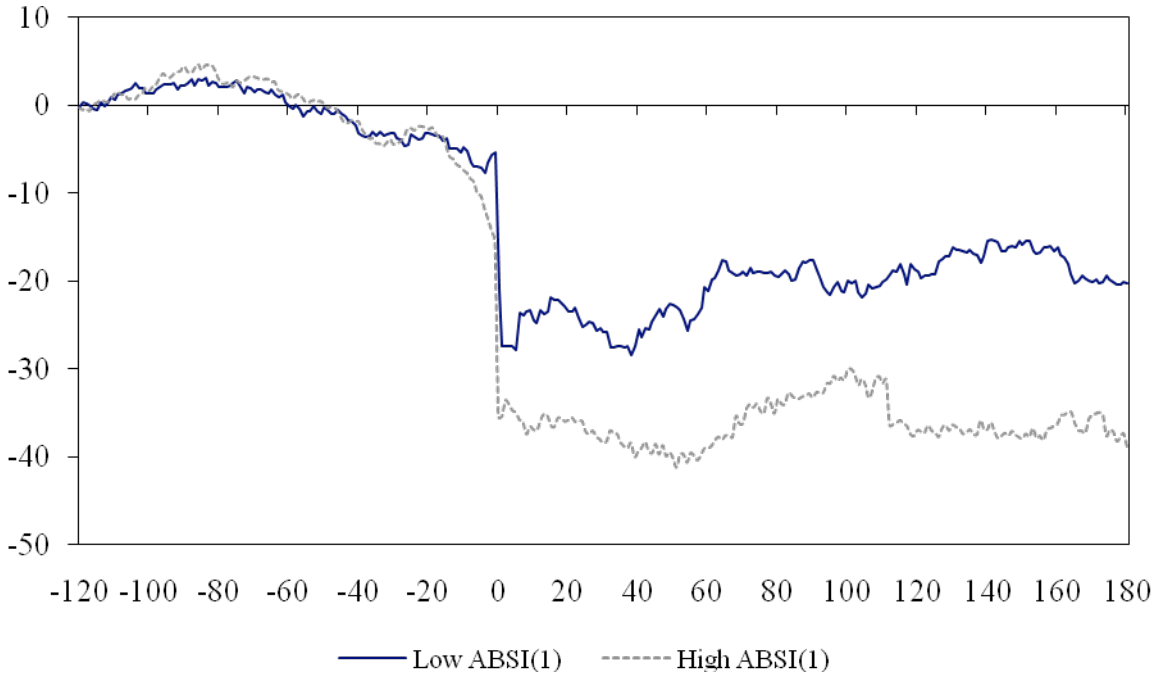


Figure IA.II: Stock Price Behavior After Revelation

The figure plots the price paths over the 300 days around the public revelation of misconduct for the two groups of firms in our SEC enforcement action sample. The vertical axis is the cumulative excess return, and the horizontal axis is the day relative to the day when the financial misconduct is revealed to the public. Firms are partitioned into two groups based on the level of the first measure of abnormal short interest, measured at the end of the month before the public revelation of misconduct.

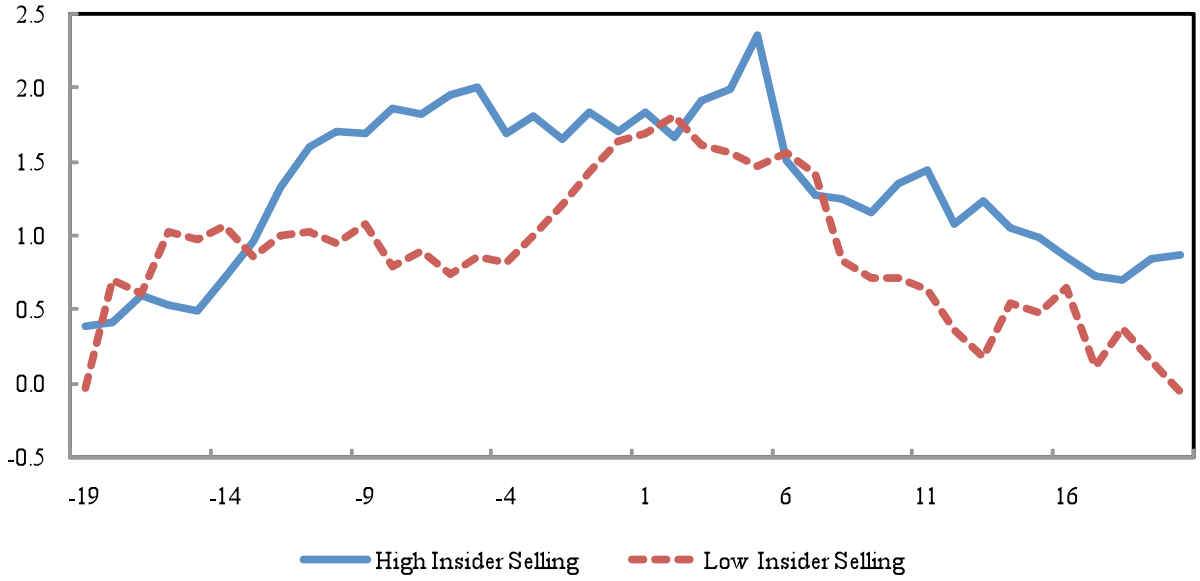


Figure IA.III: Patterns of Abnormal Short Interest and Insider Selling

This figure plots the abnormal short interest in the 40 months around the revelation of misconduct for two subsamples of firms. All firms are partitioned into two groups based on the average insider selling during the violation period. High insider selling group are those with inside selling above the median level of insider selling of our SEC enforcement action sample, and low insider selling group includes those below the median level. Month zero is the month when financial misconduct is revealed to the public. This graph plots the third measure of abnormal short interest *ABSI(3)*, although the results are similar using *ABSI(1)* or *ABSI(2)*.